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The Illuminating Engineering Society.

The report printed elsewhere of the Philadelphia convention of the Illuminating Engineering Society gives an indication of the remarkable progress which this vigorous body has made since its foundation, less than three years ago. The registered attendance of more than one-quarter of the membership enrollment denotes not only the personal interest in the society by its members, but also indicates that the objects of the body are regarded as of live importance by those connected with the art of illumination. That this belief is not misplaced is evident from a glance at the titles of the entries of the program, for the 18 papers included form a contribution to technical literature rarely equaled by the convention program of any of the older societies. The success of the meeting was also in no small part due to the Philadelphia committee of arrangements, whose methods set a new standard of efficiency in the organization and conduct of a technical convention.

The address of Dr. Bell is of the greatest interest, both in subject and in text. It is high time that recognition be accorded to the fact that in street lighting this country is far behind the leading European countries, and measures taken to give the subject of street illumination the status of an art. Until it has been brought to a plane when city authorities realize that in dealing with public lighting they have to do with an art fortified by well-established data free of suspicion, the central station will labor under a handicap due to the present lack of authoritative dicta to support suggestions they may offer in the interest of more efficient street illumination. The society would perform a service of great value by the appointment of a committee with instructions to formulate the data of street lighting, and recommend sets of specifications for the lighting of streets of different classes.

The paper by Mr. L. B. Marks on the design of the illumination of the Carnegie libraries in New York is a contribution of unique importance to the practical side of illuminating engineering, and that by Mr. Carl Hering accomplishes an excellent purpose by systematizing the calculation and comparison of light sources. The papers by Dr. H. E. Ives and Mr. L. J. Lewinson place on record data of much interest and value, the former in relation to natural illumination and the latter as to the color composition of artificial sources of light. Mr. F. E. Cady in his paper on light production from the incandescent filament treats a subject which has heretofore suffered from lack of exact experimental investigation. The paper by Dr. A. H. Elliott, on the illuminating value of petroleum oils, is doubly valuable from the exhaustive tables of data which it includes, and the paper by Mr. J. E. Woodwell, and that by Messrs. V. R. Lansingh and T. W. Rolph are notable for the useful practical data they contribute. The above-mentioned papers are referred to specifically owing to the data of permanent value contained, and we regret that lack of space will not

permit characterization of the remaining excellent papers on the program dealing with other interesting phases of the science and art of illumination.

New York Electrical Show.

An admirable electrical show is now being given in New York to commemorate the jubilee of the Atlantic Submarine Cable of 1858 and the completion of the first twenty-five years of regular electricity supply on Manhattan Island. It is well to bear such important anniversaries in mind, and to associate the public with their celebration; while they always help to give pith and point to what may otherwise be a tame and hackneyed affair. The opening exercises of last Saturday night were certainly unique in being conducted entirely by phonograph; and the regular receipt and publication of news bulletins at the show by wireless telegraphy is certainly a piquant touch of irony in connection with a jubilee of the telegraph cable. But it is such things that serve to indicate the protean nature and ubiquity of the agent we call "electricity."

One of the most interesting features to the electrical engineer is the extraordinary collection of early apparatus and devices connected with electric lighting circa 1882. How the art could live down and survive such wonderful monstrosities is a marvel. And yet each primitive fuse, socket, ceiling block, switch, meter, combination fixture, was one step in a painful evolution; and the better practice of to-day has literally risen on these stepping stones of its past to higher safety, efficiency and economy. As Mr. Edison indicated in his brief eloquent introductory remarks —on the phonograph—as president, there is just as much opportunity to-day as there ever was for improvement; and anyone who looks around that exhibition will realize that progress is being made right now at a pretty rapid pace. Particularly well worth study is the small but choice and thoroughly illustrative display of electrochemical products, and of practical electrical furnaces for ordinary circuits.

To central station men, the effect of the tungsten lamps and flaming arcs will probably be the most impressive part of the exhibit. Both are very liberally in evidence, and the volume of light obtained is remarkable, while the white and gold effect —to put it broadly—is most brilliant and effective. To come out of the show into the streets is apparently to be plunged into darkness, and yet the vicinity of Madison Square Garden is one of the brightest spots in New York City. There can be no doubt that visitors to the show go away with eyes keyed up to higher demand for illumination on the street and in the home.

Tungsten Lamps and Obligatory Free Renewals.

At the Colorado electric light convention in September a question was raised and discussed as to whether the numerous electric light companies in Colorado and elsewhere that are operating under franchises which require the company to furnish free lamp renewals could be required to furnish free renewals of tungsten lamps. Of course, at the time these ordinances were passed there was in most cases no thought of such a thing as the tungsten lamp. With tungsten lamps in their present state of fragility and high price, it is not likely that the question will come up, as to supply free renewals would so obviously impose great additional burdens on the company that no court would be likely to decide that such a requirement was in accordance with the spirit of the franchise. In the course of time, however, as the tungsten lamp comes to be more generally known, and it is lower in price, there is likely to come a demand for free renewals of these lamps. There is evidently a fine chance for difference of legal opinion on this point. A somewhat parallel case came up in Chicago several years ago in connection with telephone rates. The old franchise rate for a telephone with unlimited service was $125 a year. Later as metallic circuits, improved transmitters and other improvements came in the company kept on giving the old kind of service at the old rate, but also gave improved instruments and service at a higher price. The court held that the subscribers paying the old rate were entitled to the improved service without extra cost. In the case of tungsten lamp renewals it would seem likely that the court would be largely influenced by the general state of the art and the cost of tungsten lamps. It is not a question that need cause companies any alarm, because in the long run courts and commissions can be depended upon to assure fair play. Should the tungsten lamp be perfected to a point where cost and breakages are reduced nearly to the level of carbon lamps, the companies could easily afford to furnish them; on the other hand, if the cost of the tungsten lamps remains high it is not likely that any court would require it.

An Electric Iron in Every Residence.

Two years ago the idea set before central-station men of having an electric flatiron in service in every connected residence seemed difficult of attainment, and something to be dreamed of and worked toward rather than realized. Recent reports from central-station companies at various conventions, however, appear to indicate that several companies are closely approaching this saturation point. Even in houses and apartments where the washing is ordinarily sent out, the convenience of the electric iron has caused it to be purchased for ironing occasional small pieces. It is unquestionably the best paying and most universally popular electric heating appliance on the list, and it is to be regretted that there are not more like it. Those companies which have succeeded in placing electric irons in practically every residence with a very beneficial effect on the revenue, are now casting about for the next best thing to push. Preferences are divided among the coffee percolator, chafing dish and toaster. These will usually produce less revenue per month than an iron and are higher in first cost. Nevertheless, public education to the conveniences of these things can do much to hasten their introduction.

Waterworks Pumping.

The operation of waterworks pumps by electric motors supplied from central stations or water-power electrical plants, has been successfully introduced in a number of small cities, but the practice is by no means so common as it should be. There are, however, sufficient precedents to fortify any small central station which may find an opening for this application of electric power. In the case of larger cities, of 20,000 population or over, such installations are rare, as it is an up-hill job to overcome the unwillingness of city waterworks officials to accept statements that electric pumping is economically feasible. In many cases, too, the electric power company has felt that waterworks pumping in a large town is too much of an under-

taking for it. It is true that a large steam waterworks pumping plant usually employs the most economical type of engine, and it has been felt that for a central station company whose engines show considerably greater coal consumption per horse-power-hour to attempt to underbid such a plant would be to invite sure failure. In this connection sight is usually lost of the fact that the central station if it were working on a constant load like water pumping would show a much better economy than it does on the variable load upon which it actually works. As a general proposition, the electric power company in a town could carry the waterworks load without adding to its operating expense an amount equal to the present cost of the steam pumping. The larger the city, the larger the waterworks steam plant, and the more economical it is likely to be. But the same thing is true of the electric power plant. Of course, each case must be figured out according to local conditions, but in a general way conditions are by no means unfavorable to electric pumping. Even if the fuel economy is nearly the same there is a chance for saving on labor and incidentals. It is also to be remembered that the electric power plant in a community, if its business has been well developed, is larger in proportion to the waterworks plant than it was in the earlier days of the electric light and power business. This in itself will tend to make it easier for the electric plant to furnish the waterworks power than it would have been formerly. Of course, the argument is still stronger where hydro-electric power is available. In this issue we print a description of the new electric centrifugal pump which is now pumping all the water for the city of Duluth, which installation promises to be a valuable precedent in electric pumping. It is saving the city of Duluth money both in first cost and in cost of operation, as compared to its steam pumping plant, and this is by no means a small plant either, the capacity being 13,000,000 gal. per day for the electric pump and 10,000,000 gal. for the steam pumps. It is also encouraging as showing that centrifugal pump efficiency can be pushed much higher than has commonly been supposed. An over-all efficiency of transformers, motor and pump of 73 per cent is certainly much better than we have been led to expect of the carelessly designed small centrifugal pumps which have been common up to the present time.

Secular Changes in Standard Resistances.

A report of a committee of the British Association for the Advancement of Science, dealing with electrical units, has recently been published. It contains much material, and some very interesting information, especially in regard to standard resistances. It is reported that ten mercury resistance standards, in glass tubes, constructed and measured in 1902-3, were again set up and intercompared in 1907. Each of these mercury standards had a resistance of approximately one ohm. The differences between their respective values, as measured in 1903 and in 1907, averaged less than 1/1000 of one per cent, or one part in 100,000. Only in the case of one of the tubes was the difference material. This is a very satisfactory presentation concerning the reliability of mercury primary standards. It is also mentioned that the relative values of the French mercury standards found in 1885 and 1905, and also of the German Reichsanstalt mercury standards found in 1893 and 1904, are in very good agreement. From these statements we may feel content with the present permanence of the primary ohm standards maintained in our national physical laboratories.

All secondary standard resistances are made of solid metal as distinguished from mercury. Consequently the permanence of our standard wire resistance coils is almost as important as the permanence of the primary mercury column resistances. The report details, at considerable length, the history of a number of wire standards that have been under observation since 1867, and with which, therefore, an experience of forty years' duration has been obtained. It appears that out of nine standard one-ohm coils, two of which were of platinum, one of platinum-gold alloy, two of platinum-iridium, and four of platinum-silver, the two platinum coils have remained constant throughout, while the average of the maximum changes detected in the alloy coils is an increase of about one-tenth of one per cent, or one part in 1000. This is a large increase from a physical standpoint, and a considerable increase from an engineering standpoint. It is not clear whether the variations that have occurred in the resistance of the standard alloy coils have been due to changes produced from within or from without. Changes from within might, for example, be caused by crystallization of the metal, or by any alterations in its molecular structure taking place with age. Changes from without might be due to stresses imposed on the wire by temperature deformations of the insulating medium surrounding the wire, or by the absorption into the wire of substances from the insulating medium. If, however, the changes were from without, it would be reasonable to suppose that they would have been also produced in the two platinum coils that apparently did not vary. Certain manganin resistance coils—twenty-two in all—have been under observation and record for the last five years. Their resistances range from 0.001 ohm to 10,000 ohms. Some of these coils have hardly varied in this period as much as one part in 10,000. A few have, however, varied several parts in 10,000, and one in particular, a 1000-ohm coil, is reported to have steadily increased nearly one part in 1000. The report does not explain this large variation. It is merely pointed out that some manganin coils have had a very steady history of practically no change, while other manganin coils have been less fortunate in this respect.

It might be argued that because in forty years two standard platinum coils have apparently not changed appreciably in resistance, whereas coils of various kinds of alloy have changed appreciably, that in future all standard coils should be of platinum. This conclusion, however, is hardly warranted, because platinum has a considerable temperature-coefficient of resistivity, and platinum coils have their resistance markedly affected by temperature; whereas manganin has a very small temperature-coefficient of resistivity, so that for many practical purposes the temperature of a manganin standard coil does not need to be taken into account. Consequently, we shall do better to keep to alloy coils in our secondary standard resistance boxes, if we check them at intervals of a few years, because the temperature error with platinum coils is likely to exceed many times the secular error of the alloy coils. At the same time, researches to determine and avoid the causes of variation in the resistances of alloy coils would be of much utility, if successful. It is of minor importance and cold consolation to learn that some manganin coils do not vary. We ought to know why other manganin coils do vary, and how to avoid such coils.

Electricity at the Boston Food Fair.

The opening of the seventh annual Food Fair of the Boston Retail Grocers' Association, at the Park Square Coliseum, on Sept. 28, was marked by an electrical illumination which surpassed practically all the previous work of this character in connection with these expositions. Over 30,000 incandescent lamps were installed for the lighting of ceilings, exhibition booths, balconies, balustrades and roof gardens. The exhibition hall, 750 ft. long, was provided with special illumination furnished by 60 egg-shaped ceiling clusters, each carrying 120 32-cp lamps, and being 12 ft. long and 9 ft. in circumference. The predominating colors of the general scheme of decoration are old gold and light blue. The special egg-shaped clusters are installed in three rows, the two outer rows having a central strip of blue lamps, while the central row has plain lamps. The gallery fronts and posts are outlined in incandescents, and the exhibits are fitted with border lamps, concealed wiring being used in all cases. A number of small motors have been installed to operate apparatus in exhibits, such as a cider mill, coffee grinders and similar grocery-store applications. Current is supplied by the Edison Electric Illuminating Company, of Boston, and the general scheme of decoration was executed by Mr. M. A. Singer, of New York.

Convention of the American Street & Interurban Railway Association.

The annual convention of the affiliated associations comprising the American Street & Interurban Railway Association will be held at Atlantic City, N. J., Oct. 12 to 16. Two convention halls located on Young's new million-dollar pier, and each capable of seating approximately 300 people, will be provided for the meetings of the convention. In addition suitable meeting rooms are available in the Chalfonte Hotel and in the Traymore Hotel. All the meetings of the American Association and of the Transportation & Traffic Association will be held in the Greek Temple near the outer end of the convention pier. The Accountants will hold their two sessions on Wednesday at the Chalfonte Hotel and their Thursday and Friday sessions in the Aquarium Court Hall near the boardwalk-end of the convention pier. The Engineers will hold their Tuesday and Wednesday sessions in the Aquarium Court Hall and their Friday session in the Greek Temple. The Engineers will have no Thursday session, that day being set apart for the inspection of exhibits. The Claim Agents will hold all of their sessions at the Traymore Hotel. The Manufacturers' Association has prepared a magnificent exhibit which will cover the entire area of Young's new million-dollar pier. One hundred and fifty different companies have already been assigned exhibit space. The usual entertainment features will prevail. The programs are as follows:

ACCOUNTANTS' ASSOCIATION.

Tuesday, Oct. 13, 2 to 5 p. m.—Registration and badges.

Wednesday, Oct. 14, 9:30 a. m. to 12:30 p. m.—Convention called to order; annual address of president; annual report of executive committee; annual report of secretary-treasurer. Paper, "Organization of Accounting Department of Electric Railway and Light Company," by Mr. A. R. Paterson, general auditor, Savannah Electric Railway, Savannah, Ga. Report of committee on blanks and forms; appointment of convention committees; new business.

Wednesday, 1 p. m.—"Get Together" luncheon.

Thursday, Oct. 15, 9:30 a. m. to 12:30 p. m.—Paper, "Interline Accounting of Interurban Railways," by Mr. W. H. Forse, Jr., secretary and treasurer, Indiana Union Traction Company, Anderson, Ind.; paper, "Accounting Methods of a Holding Company," by Mr. P. S. Young, comptroller Public Service Railway Company, Newark, N. J.; report of committee on standard classification of accounts and form of report; report of committee on international form of report.

Friday, Oct. 16, 9:30 a. m. to 12:30 p. m.—Paper, "The Effect of Electrification on the Accounting Methods of Steam Railways," by Mr. A. B. Bierck, general auditor, Long Island Consolidated Electrical Companies, Long Island City, N. Y.; report of convention committees; election of officers; installation of officers; adjournment.

CLAIM AGENTS' ASSOCIATION.

Monday, Oct. 12, 9:30 a. m. to 12:30 p. m.—Registration and badges.

Monday, Oct. 12, 2 p. m. to 5 p. m.—Convention called to order; annual address of the president; annual report of the executive committee; annual report of the secretary-treasurer; appointment of committees.

Tuesday, Oct. 13, 9:30 a. m. to 12:30 p. m.—Paper, "The Organization of a Claim Department for a Small or Moderately Large Company, Including a School of Instruction as a Means of Preventing Accident," by Mr. Francis J. Ryan, M.D., Syracuse Rapid Transit Railway, Syracuse, N. Y.; paper, "The Claim and Its Disposition," by Mr. Peter C. Nickel, claim agent, New York City Railway, New York.

Tuesday, Oct. 13, 2 p. m. to 5 p. m.—Paper, "Uniformity in Claim Department Records and Accounts," by Mr. John J. Reynolds, Boston Elevated Railway, Boston, Mass.; paper, "The Duties of Claim Agents and Other Officials of Quasi-Public Corporations to the Public," by Mr. Eugene R. Roberts, attorney, Knoxville Railway & Light Company, Knoxville, Tenn.

Tuesday, Oct. 13, 8 p. m.—Social smoker and entertainment.

Wednesday, Oct. 14, 9:30 a. m. to 12:30 p. m.—Question box; discussion, "The Medical Side of the Prevention of Accidents"; general business; reports of convention committees; report of nominating committee; election of officers; installation of officers; adjournment.

ENGINEERING ASSOCIATION.

Tuesday, Oct. 13, 9:30 a. m. to 12:30 p. m.—Registration and badges.

Tuesday, Oct. 13, 2 p. m. to 5 p. m.—Convention called to order; address of the president; annual report of the executive committee; annual report of the secretary-treasurer; appointment of convention committees; new business; report of the committee on maintenance and inspection of electrical equipment.

Wednesday, Oct. 14, 9:30 a. m. to 12:30 p. m.—Report of committee on standardization; report of committee on power generation.

Wednesday, Oct. 14, 2 p. m. to 5 p. m.—Report of committee on control; report of committee on power distribution.

Thursday, Oct. 15, 9:30 a. m. to 12:30 p. m.—Inspection of exhibits.

Thursday, Oct. 15, 2 p. m. to 5 p. m.—Inspection of exhibits.

Friday, Oct. 16, 9:30 a. m. to 12:30 p. m.—Report of committee on car and car-house wiring; report of committee on operating and storage car-house designs; question box.

Friday, Oct. 16, 2 p. m. to 5 p. m.—Report of committee on way matters; report of committee on economical maintenance; general business; report of nominating committee; election of officers; installation of officers; adjournment.

TRANSPORTATION & TRAFFIC ASSOCIATION.

Monday, Oct. 12, 9:30 a. m. to 12:30 p. m.—Registration and badges.

Monday, Oct. 12, 2 p. m. to 5 p. m.—Convention called to order; address by Mr. W. Caryl Ely; address of the president; report of organization meeting; annual report of the executive committee; annual report of the secretary-treasurer; appointment of convention committees; reports of special committees; paper, "How Can a Small Road Best Promote Traffic and Increase Its Revenues?" by Mr. Ernest Gonzenbach, general manager Sheboygan Light, Power & Railway Company, Sheboygan, Wis.; report of committee on training of employees.

Tuesday, Oct. 13, 9:30 a. m. to 12:30 p. m.—Paper, "Carrying of United States Mail on Electric Railways, the Compensation Therefor, Its Advantages and Disadvantages," by Mr. C. H. Hile, assistant to vice-president, Boston Elevated Railway, Boston, Mass.; paper, "Progress to Date in Carrying Freight and Express Matter by Electric Roads—Some Mistakes that

Have Been Made and Their Remedy," by Mr. C. V. Wood, general freight and passenger agent, New England Investment & Security Company, Boston, Mass.; report of committee on freight and express.

Wednesday, Oct. 14, 9:30 a. m. to 12:30 p. m.—Symposium, "The Possibility of a Well-conducted Publicity Department"; report of committee on interurban rules.

Thursday, Oct. 15, 9:30 a. m. to 12:30 p. m.—Paper, "The Operation of Multiple Car Trains on Interurban Roads," by Mr. D. F. Carver, Brooklyn, N. Y.; report of committee on passenger traffic; report of committee on rules for city operation; general business; report of nominating committee; election of officers; installation of officers; adjournment.

Massachusetts Institute of Technology Opens.

The forty-fourth year of the Massachusetts Institute of Technology began on Sept. 30. The indications point to as large, if not a larger, enrollment of students as in any recent year. In the physics department, Messrs. Eames and Faxon have been engaged to fill the vacancies left by Messrs. Hollnagel and Kendall, on leave of absence. An important addition to the facilities of the institute was opened this fall in the shape of a new Technology Union building, located on Trinity Place. This building is designed to facilitate the social intercourse of students and enhance the esprit de corps frequently absent in technical schools. The structure is 63 ft. long, 60 ft. wide and 30 ft. in height. There are two main floors and a mezzanine floor. The first floor will be used as a dining hall. The second floor will be used as a social room, library and for private club dining. The mezzanine floor is occupied by the offices of the various student organizations. Checking rooms, toilets and a postoffice are also installed in the Union.

Brooklyn Edison N. E. L. A. Section.

A meeting of the employees of the Edison Electric Illuminating Company of Brooklyn was held at the Edison Club Rooms, Johnston Building, Brooklyn, Sept. 28, preliminary to the formation of a company branch of the National Electric Light Association, in pursuance of the Doherty amendments to the constitution of the association made at the convention in Chicago. This preliminary meeting, which was attended by about 80 employees, was presided over by W. F. Wells, general superintendent of the company, who explained the individual and co-operative benefits to be derived by membership in the National Association through the company branch.

It was pointed out that this was an opportunity for self-improvement and for broadening through association with others in various branches of the industry, and that it could not fail to be of service in personal development and in bringing about recognition of talent within the ranks of the Brooklyn organization. Mr. Wells stated that membership would be entirely a matter of choice, and that positively no pressure whatever other than moral suasion would be brought to bear upon employees to induce them to join. Mr. W. W. Freeman, general manager of the company, also addressed the gathering and showed how membership in the company branch would help to keep employees posted as to up-to-date practice in the different departments of electrical activity and would tend to make their services more valuable to themselves and to the company.

On motion a committee on organization to be composed of one member from each department of the company was provided for, the committee to recommend candidates for election as officers of the new company branch and to report to the next meeting.

More than 130 applications for membership have been received up to date and the prospects are that the Brooklyn company branch will be a large and useful addition to the National Electric Light Association.

Meeting of the New York Section of the Illuminating Engineering Society.

The first autumn meeting of the New York section of the Illuminating Engineering Society will be held Thursday evening, Oct. 15, at 8:15, at the United Engineering Societies Building, 33 West Thirty-ninth Street. A committee consisting of Dr. A. H. Elliott, Mr. Norman Macbeth and Mr. E. F. Tweedy will review the papers and discussion presented at the Philadelphia convention. The meeting has been arranged so that the New York members who were unable to attend the convention will receive first-hand information concerning everything of significance and moment which transpires at the convention. All persons interested in illuminating engineering are invited to be present.

Arkansas Association of Public Utility Operators.

The first annual convention of the Arkansas Association of Public Utility Operators was held at Little Rock, Ark., on Sept. 17 and 18. D. A. Hegarty, treasurer and general manager of the Little Rock Railway & Electric Company, is president of this new association, which now has about 75 members. It is the purpose of this new body to discuss questions of policy and methods of operation for all classes of public utility organizations. The program at the first meeting included papers on various subjects of interest to railway, electric lighting, water and gas property officials, among them being papers on the advantages and disadvantages of the tungsten lamp to central stations, by Mr. T. R. Phillips and Mr. C. E. Mathes, of the Little Rock Railway & Electric Company, and on the theft of electricity, water and gas, by Mr. D. A. Hegarty.

Wakefield, Mass., Lighting Committee Reports Against Municipal Ownership.

At a special town meeting held on Sept. 21 in Wakefield, Mass., the committee on lighting appointed at the March town meeting to report upon the municipal light plant and its extension presented a finding to the effect that it would be better for the town to purchase electricity from the Malden Electric Company than to continue to generate its own current. The investigation made by the committee was very exhaustive, and included consultations with a considerable number of electrical and central-station engineers, manufacturers' representatives and other experts, with visits to power plants in the vicinity of Boston. The town of Wakefield has a population of about 10,000 according to the census of 1905, and for many years it has operated and owned a municipal lighting plant. This plant is now out of date and for some time the lighting commission of the town has desired to secure an appropriation sufficient to re-establish it on a modern basis, the estimated expense being about $40,000. The report of the special lighting committee, however, strongly advises against municipal ownership and reviews the whole street lighting situation in an able manner. There are eight members of this committee, the chairman being Mr. G. M. Poland, and the secretary, Mr. F. J. Henkel.

The committee recommends a change in the street lighting in harmony with modern practice, pointing out that 93 existing direct-current open-arc lamps should be discarded on account of their unreliability and cost of repairing and trimming. In place of these and all 25-cp incandescents now in use the town is advised to substitute 16 enclosed arc lamps, bringing the whole number to 50, and 400 40-cp tungsten lamps. The arc lamps are to be placed on street corners and at railroad crossings, the tungstens being installed in places where foliage or other obstructions preclude the use of arc lamps. Many of the present arc lamps are not giving light in proportion to their cost and current consumption. Many streets not now illuminated by arc lamps can be efficiently lighted by tungstens with

much less cost than at present. The existing installation of 192 25-cp incandescent lamps is to be replaced by an equal number of tungstens requiring 45 per cent less current, and giving a longer life and better quality of light. By replacing 77 direct-current open-arc lamps with 200 tungstens a large saving will be made in current consumption and also in the ultimate cost of operating the whole system. The cost of this is:

1 30-kw, 6.6 amp, constant-current transformer	$600
16 6.6-amp enclosed arc lamps, at $21	336
400 6.6-amp tungsten series lamps, at $1.58	632
204 series incandescent fixtures, wave reflectors, at $5.50	1,122
10 per cent for incidentals	269
Total	$2,959

Future extensions are not figured in this estimate.

The total cost of operating the 50 enclosed arc lamps and 400 40-cp tungstens on the basis of 86,400 kw-hours output per year will be $2,808, if current is purchased, the lights burning 1800 hours per year. The cost of operating the present system of street lighting, 196 25-cp incandescents, 34 enclosed arcs and 93 open arcs, with purchased current would be $4,299.75. The saving on the new system of lighting over the old will be $1,491.75, exclusive of a net saving of $800 on the cost of trimming arc lamps. Comparing the new system with purchased current at a cost of 3¼ cents per kw-hour with the old system at the present cost of generating (4.6 cents per kw-hour), the saving will be approximately $3,277. There will also be a saving of $837 on current delivered to commercial consumers, making a total saving of $4,114 on current and an added minimum saving of $800 on arc-light trimming, provided the town purchases current and changes the system as recommended.

The present switchboard is out of date and unsafe, according to the report. It is recommended that a modern board be installed with two BR regulators at a cost of $3,500. By omitting the two regulators, the cost will be $1,500 less, but the expenditure will reduce labor costs to the minimum, give more uniform voltage and allow free lamp renewals. At the meeting the town voted to install the new system of lighting and the switchboard.

After considering various prime-mover installations, high- and low-pressure steam plants, several gas-producing outfits and oil engines, having had estimates and contracts submitted for various sizes and kinds of power units, some based on the present requirements of the plant and others large enough to care for an increased amount of electrical business, the committee has unanimously reached the conclusion that it is at present unwise for the town of Wakefield to build and equip a new electrical generating plant. In view of the fact that the town is advantageously situated in being able to buy current from four central stations outside, and considering the very small outlay necessary to enable the town to purchase current, the committee believes that the wisest course for the town to pursue is to purchase its electricity. The proposition of the Malden Electric Company is recommended as the best for the town to accept, both as to price of current and the initial expense required on the part of the town to bring the current to the plant for distribution.

The Malden Company's proposition is that the company will build and operate the required transmission line from its station in Malden to the Wakefield power plant, will furnish the necessary step-up and step-down transformers for a capacity of 500 kw demand (present maximum demand, 140 kw), the line voltage to be operated at either 6600 or 13,200 volts as necessity requires, delivering current at the Wakefield switchboard at approximately 2200 volts, 60 cycles, three-phase, for a term of five years at the following prices:

On the basis of a minimum guarantee of 200,000 kw-hours per year, said minimum to be made up of 150,000 kw-hours of peak current and 50,000 kw-hours of non-peak current, a rate of 3¼ cents per kw-hour. In addition, for such non-peak current as may be used in excess of the first 50,000 kw-hours of non-peak current per year, a rate of 2 cents per kw-hour. The company defines non-peak current as that used between 1 a. m. and 5 p. m. from Sept. 15 to Nov. 15, and from 1 a. m. to 4 p. m. from Nov. 15 to Feb. 15. The town is to provide foundations in its power plant for the transformer equipment. The cost of making the necessary changes in the Wakefield pole line to give a cross-arm location for the supply from Malden will be about $500. The town will furnish only the space, and the company will provide line material and erection. These poles can also be used for the general distribution of the town for commercial and street lighting service. The total expense for supplying current from Malden to the town switchboard will be about $500 for poles and $300 for a brick transformer house.

The committee states that the Malden Company's proposition is the best, for the following reasons:

1. On account of the small output of current and present demand it is deemed inexpedient for the town to manufacture its own current.

2. The amount of current consumed in the town is so small that the plant cannot now be operated to advantage more than seven hours per day.

3. To purchase current from the central station requires the expenditure of a very small sum by the town, whereas to manufacture by any modern prime mover requires a very large outlay. The town now consumes about 40,000 kw-hours of non-peak current, and purchases this from Malden when the municipal plant is not running. After a sufficient amount of day business has been secured to raise the amount of non-peak current to 50,000 kw-hours, the price for all non-peak current in excess of 50,000 kw-hours will be 2 cents per kw-hour, which is less than one-half of what it costs the town at present to manufacture current, and will enable the town to sell power at favorable rates and will make it possible for the plant to secure the power business said to exist without the investment of a large sum of money in a modern economical power plant. Furthermore, the responsibility and anxiety of those in charge of the present lighting system will be lessened and loss to the town in operating an expensive plant while waiting for the power business to develop will be prevented. The town will assume none of these risks in buying energy from the central station.

4. By purchasing current the town will save 30 per cent of what it cost last year to manufacture, with a small investment as outlined, and will be in a position to furnish three times the amount of current now consumed, with no additional outlay for station equipment. With no prime mover the minimum amount of labor is required with the elimination of extraordinary repairs, fly-wheel accidents and broken cylinders. The town will not be affected by varying prices for coal and oil, the cost of current will be a fixed item throughout the term of the contract, and at its expiration the town will be in a position to either make better terms or build another plant if necessary. The committee states that it is convinced by investigations of the towns supplied by the Boston Edison Company that minimum care and expense is required to maintain reliable service.

5. The municipal light commissioners advocated the installation of a gas-producer engine plant at an expense of about $40,000, but the committee feels that gas-producer engines introduce factors in central-station operation which tend toward complications in operating and manufacturing, multiplying the possibility of accidents, and adding great responsibilities to those in charge of the plant. It is felt that great improvements will be made in both gas and oil engines within the next few years. It is pointed out that if the town installs gas engines providing for the present capacity, the only way in which additional capacity can be provided as the plant grows is by purchasing additional units costing in the vicinity of $100 per horse-power. The town must add units of 100 hp or more each, whence the town will soon be confronted with a large additional expenditure, inefficient to operate until the additional demand becomes equal to the capacity of the whole plant. Finally, the cost of the producer plant is not advisable for the town to assume at this time, particularly in the absence of overload capacity in the gas engine. If the current is measured on the secondary side of the step-down transformers, the town will have a minimum loss, and operation will be at the highest efficiency at all hours of the day.

Labor Requirements in Representative Massachusetts Central-Station Organizations.

Statistics recently submitted to the Massachusetts Board of Gas and Electric Light Commissioners in connection with the annual statements of the central-station companies of the State enable the following compilations to be made relating to labor requirements of the 10 representative ensuing companies. It is well recognized that the cost of skilled and unskilled labor is an important factor in the operating expenses of the modern central station, but the relations between number and classification of employees, the size of plant and volume of business have rarely been treated in the technical press. On account of differences in operating conditions a tabular comparison will be made in brief form, as follows:

Company.	Approximate population served.	Total income.	Total expenses.	Total number employees.
Edison Electric Illuminating, Boston	707,201	$4,229,239.02	$2,690,418.61	887
Worcester Electric Light	128,135	334,528.92	172,050.05	86
Lowell Electric Light Corporation	106,401	331,269.27	220,530.83	61
Fall River Electric Light Company	105,762	237,054.54	168,455.96	54
Malden Electric Company	101,129	264,523.73	179,950.92	47
Cambridge Electric Light Company	97,434	297,238.51	166,232.13	60
Lawrence Gas Company	89,972	222,242.08	125,668.55	62
Lynn Gas & Electric Company	89,358	370,577.32	225,313.35	86
United Electric Light Company, Springfield	86,486	465,682.35	253,471.57	117
New Bedford Gas & Edison Light Company	78,597	153,249.21	77,383.30	20

In the above table the population served is taken from the 1907 report of the Gas and Electric Light Commission. The incomes and expenses are for the year ending June 30, 1908.

BOSTON EDISON COMPANY.

The labor classification in detail for this company is as follows:

Generating steam division	136	employees
Generating electrical division	98	employees
Distribution department	284	employees
Offices and supply department	277	employees
Construction department	49	employees
Transportation	22	employees
Laboratory	21	employees

On the Boston Edison service are 21,719 customers located in some 27 cities and towns covering upward of 400 sq. miles in territory. The operation of the system involves the use of 25 power or substations. The total boiler capacity of the company is 26,731 hp, and the total rated horse-power of the company's engine and turbine units is 73,500. There are 28 steam prime movers in the power plants, and the total kw-hours manufactured in the year ending June 30, 1908, was 88,535,490. The total energy accounted for and distributed was 60,798,606 kw-hours and the maximum load was 35,511 kw. The coal consumption was 102,717 tons. Wages at the stations came to $170,393.66; salaries of officers to $47,500, and general salaries to $276,177.56. Wages for the care of lights and meters, clerical labor in that department, salary and commission of collectors came to $10,511.83. There are 938,670 (16 cp) equivalent incandescent lamps installed in 10 storage batteries in the company's stations, 25,222 meters in use, and 3969 street lighting arcs in service. The total length of conduits in June, 1908, was 503,785.3 ft., ranging in size from single to 54 ducts each. In these were installed 5,655,136 ft. of cable, ranging in size from telephone wire to 2,000,000 cm. There are 1686 manholes, 91,990 ft. of feeder tubes, 390,930 ft. of main tubes and 574 junction boxes on the system. The total length of overhead wire on the system is 16,884,576 ft., carried on 27,049 poles and 104 mast-arm or roof supports.

WORCESTER ELECTRIC LIGHT COMPANY.

The employees at Worcester are divided as follows:

1 Electrician.	4 Teamsters.
4 Engineers.	15 Linemen.
5 Firemen.	6 Patrolmen.
16 Station men.	4 Trimmers.
3 Machinists.	19 Laborers.
1 Carpenter.	5 Clerks.
3 Foremen.	

The small number of trimmers is due to the use of the magnetite arc system for street lighting. The Worcester Company has 2419 customers, one power station of 3000-hp boiler capacity and 5900-hp engine and turbine capacity, there being 12 boilers and five steam-generating units. The total kw-hours manufactured last year was 5,400,192, and the total energy sold was 4,530,644 kw-hours. The coal consumption was 7868 tons. Wages at the station were $19,429.59; salaries of officers, $11,300; general salaries, $3,909.30; collection and meter wages, $15,265.03. The company had installed June 30 311,306 ft. of conduit, the greater part being the four-duct size. There are 826 street lighting arcs, 1,265,742 ft. of arc circuits, 1,190,220 ft. of alternating circuits, and 241,484 ft. of power circuits. The company has 5848 poles and 2,834,839 ft. of cable in conduit. There are 2243 meters in service.

LOWELL ELECTRIC LIGHT CORPORATION.

The employees of this company at Lowell are herewith given as follows:

1 Superintendent.	2 Repair men.
4 Clerks.	7 Linemen.
2 Stenographers.	4 Arc lamp trimmers.
3 Solicitors.	6 Meter and lamp men.
1 Stock Clerk.	1 Arc lamp inspector.
5 Engineers.	1 Incandescent lamp inspector.
4 Oilers and cleaners.	2 Troublemen.
6 Station electricians.	1 Hostler.
9 Boiler men.	1 Draftsman.
1 Coal passer.	

The company has about 1700 customers. Its power station equipment includes 16 boilers of 3229 aggregate hp, and 11 engine or turbine units aggregating 7390 hp. Last year there were manufactured 9,426,511 kw-hours, and sold 6,746,044 kw-hours. The coal consumption was 14,101.2 tons. The maximum load was 3498 kw. Station wages were $24,742.81; salaries of officers, $12,936; general salaries, $7,210.68; collection and meter wages, $8,300.45. There are 790,097 ft. of arc circuits, 549 street arc lamps, 69,169 16-cp equivalent incandescents and 31,916 ft. of underground conduits. Alternating feeders and mains are not totalized in the return, but the company has 2968 poles and 1901 meters to care for.

FALL RIVER ELECTRIC LIGHT COMPANY.

The employee classification is not made in the return. The company has about 1650 customers. Last year its generated energy was 4,061,284 kw-hours, and sold energy, 1,819,225 kw-hours. The company burned 7630 tons of coal, and its maximum load was 1561 kw. The rated capacity of the boiler plant is 2800 hp and the steam plant 4433 hp. Station wages were $21,884.77; salaries, $11,504.21; meter and collection wages, $27,978.98. The company has 3299 poles, 2169 meters, 812 street arcs, 806,294 ft. of overhead circuits, alternating current; 154,724 ft. of Edison circuits overhead, 34,902 ft. of underground conduit.

MALDEN ELECTRIC COMPANY.

The labor assignment of the Malden Electric Company is as follows:

4 Engineers.	1 Troubleman.
3 Oilers.	1 Line inspector.
2 (Steam fitter and helper.)	5 Trimmers and patrolmen.
3 Firemen.	1 Storekeeper.
1 (Electrical engineer and assistant.)	2 Stablemen.
2 Switchboard attendants.	4 Garage men.
2 Meter inspector and installer.	1 Cashier.
2 Meter and arc lamp repairer.	3 Bookkeepers.
1 Meter reader.	1 Stenographer.
1 Superintendent manufacturing and distribution.	1 Telephone operator.
1 Superintendent line construction.	1 Office boy.
3 Foremen.	Extra linemen and groundmen as required.

There are about 3200 customers in the cities and towns of supply (Malden, Medford, Melrose, Everett). There is one power plant with four boilers (Roney stokers) aggregating 1910 hp, and five engine units aggregating about 4875 hp. The energy manufactured last year was 4,647,453 kw-hours, and sold 3,423,469 kw-hours. The maximum load was 1575 kw. The coal consumption was about 5555 tons. (About 1000 tons coke and breeze were also burned.) Station wages at Malden were $15,817.19; salaries of officers, $11,125; general salaries, $12,829.16; collection and meter wages, $10,840.93. The company has 8306 poles, 381,615 ft. of power lines, 858,380 ft. of alternating mains, 457 arc lamps and 1,019,455 ft. of secondaries. There are 3377 meters in service.

CAMBRIDGE ELECTRIC LIGHT COMPANY.

The Cambridge employees are:

4 Engineers.	1 Hostler.
6 Firemen.	1 Yard man.
3 Oilers.	1 Solicitor.
2 Coal passers.	1 Stock keeper.
4 Switchboard men	1 Carpenter.
1 Engine wiper.	5 Clerks.
2 Repair men.	7 Meter men.
1 Electrician.	2 Trimmers.
1 Line foreman.	1 Stenographer.
16 Linemen.	

There are 1693 customers. The power plant has six boilers totaling 2400 hp and four engines of 6750 total horse-power. Last year there were generated and delivered at the switchboard 6,043,204 kw-hours, and sold, 5,334,462 kw-hours. The coal consumption was 9377 tons, and the maximum load 22,772 kw-hours (on any one day). Station wages were $20,920.49; salaries of officers, $8,300; general salaries, $3,481; collection and meter wages, $26,172.79. The company has 2625 meters, 3487 poles, 31,782 ft. of underground conduit, 453,968 ft. of alternating feeders, 833,728 ft. of secondaries, and 1,002,678 ft. of arc circuits, supplying 653 arc lamps for street lighting.

LAWRENCE GAS COMPANY.

The employees in the electrical department are as follows:

1 Electrician.	23 Wiremen and linemen.
4 Engineers.	8 Patrolmen and trimmers.
11 Engineers' helpers and oilers.	1 Hostler.
2 Firemen.	5 Laborers.
2 Machinists.	1 Clerk.
3 Meter men.	1 Carpenter.

The company has 1360 customers. The power plant equipment covers 19 boilers of 4888 hp, 9 engines and turbines of 5515 hp and 6 waterwheels of 3175 hp. Last year there were manufactured 4,363,416 kw-hours, of which 3,412,861 kw-hours were sold. The maximum daily output was 19,071 kw-hours Station wages were $13,986.62; salaries, $10,689.43; collection and meter wages, $10,280.21. There are 1537 meters, 5019 poles, 5940 ft. of Edison underground feeder tubes, 7950 ft, main tubes, and 572 street arcs. The length of streets and ways occupied by overhead lines is 520,638 ft.

LYNN GAS & ELECTRIC COMPANY.

The employee list in the electrical department of this company is:

6 Engineers.	2 Patrolmen.
6 Firemen.	18 Linemen.
4 Oilers and cleaners, steam.	3 Trimmers.
2 Coal passers.	3 Patrolmen and trimmers.
4 Switchboard attendants.	3 Painters.
3 Inside wiremen and repair men.	9 Carpenters.
3 Stock clerks.	2 Troublemen.
4 Meter testers.	2 Dynamo cleaners and sweepers.
1 Lamp repair man.	3 Machinists.
1 Clerk.	4 Steamfitters.
3 Assistants to superintendent.	

There are 4071 customers. The boiler plant includes 8 units of 3100 total horse-power, and the engine room has six generating units aggregating 8200 hp. Coal, gas coal and tar were burned last year, the fuel cost being $54,158.32. The generated energy was 8,776,165 kw-hours. Of this 7,141,359 kw-hours were sold. The maximum load was 3700 kw. Station wages were $25,937.79; general salaries, $7,459.99, and salaries of officers, $2,750. Collection and meter wages came to $17,405.85. There are 4059 meters and 7840 poles. The length of streets or ways occupied by overhead lines is 863,100 ft. The total length of cable in underground conduit is 249,524 ft., there being 74,616 ft. of duct.

UNITED ELECTRIC LIGHT COMPANY, SPRINGFIELD.

This company operates a power system of wide area, with three plants at which current is generated. There are 14 boilers of 5300 hp aggregate horse-power, and in engine and turbine equipment, 8570 hp. There are available on the system 4835 hp in waterwheel capacity. The employees are listed as follows:

1 Superintendent of motor power.	1 Electrician.
10 Office force.	3 Stock men.
8 Steam engineers.	10 Meter men.
3 Firemen.	14 Dynamo engineers.
1 Chief electrician.	10 Underground men.
4 Inspectors of street lights.	14 Linemen.
6 Trimmers of arc lights.	30 Laborers.
2 Construction foremen.	

Last year the company manufactured 16,230,797 kw-hours, and sold 10,421,309 kw-hours. The maximum load was 6701 hp. Station wages were $29,753.91; salaries of officers, $11,400; general salaries, $11,381; collection and meter wages, $15,113.01. Fuel cost was $40,108.81. There are 3231 meters, 2454 poles and 189,944 ft. of streets and ways occupied by overhead lines. There are 1,083,711 ft. of underground cables installed.

NEW BEDFORD GAS & EDISON LIGHT COMPANY.

The electrical employees are:

1 Superintendent.	2 Firemen.
1 Foreman.	1 Coal passer.
4 Engineers.	3 Lamp trimmers.
4 Dynamo tenders.	1 Arc lamp repairer.
3 Oilers.	

The company has 1428 customers, supplied through 1644 meters. The power plant has six boilers of 1156 hp and six engines and turbines of 2050 hp. Last year there were manufactured 1,747,178 kw-hours, of which 1,506,802 kw-hours were sold. The maximum load was 1007 kw. Station wages were $13,312.01. Fuel cost was $15,586.22. Meter and collection wages were $9,492.07. The company has 1854 poles, 6798 ft. of main underground tubes, 2387 ft. of feeder tubes and 132,086 ft. of other than Edison cables underground. The length of streets and ways occupied by lines is 212,320 ft.

The above figures show, in a general way, for the different companies the physical plant which must be administered, and the volume of business handled. The broad variations in the number of employees in companies serving communities of about the same size and doing a comparable business suggests the importance of making further study of the relations between equipment, business and labor in individual cases.

Rates for Electricity in New York City.

At the hearing before the Public Service Commission of the First District of New York in the inquiry into the electric light, heat and power companies, Sept. 25, Mr. J. T. Cowling, general manager of the Westchester Lighting Company, was the first witness called. He declared that all the contracts of his company were on standard forms and that no special contracts were written. With the exception of a special arrangement with the New York Edison Company he said that all the contracts of his company were on the forms approved by the commission last spring. Mr. Cowling testified that his company had one general form of retail contract for all persons who bought energy for lighting and this was at 10 cents per kw-hour. The only lower rate is for energy to be used for motors exclusively. Mr. Cowling said that his company had a wholesale contract which had been devised lately, by which it would be possible for a consumer to get energy at 8 cents for 1500 kw-hours, 6 cents for 3000 kw-hours and 5 cents for 5000 kw-hours per month. These rates included lamp renewals on the 8- and 6-cent rate, which were exclusively for lighting, but not on the 5-cent rate, under which power and lighting were combined. If the customer is using the energy for motors alone, he is billed at 10 cents per kw-hour and is allowed certain discounts according to the quantity used. The business of the company, it was testified, was altogether with owners of private residences and small business houses. There was no apartment-house business. In the power contracts the discounts ranged from 10 to 60 per cent, Mr. Cowling said; the first-named discount being received by a consumer who used current at 1.73 hours per month for every kilowatt of installation. The discounts increased until the consumer received the maximum of 60 per cent when he used 8.46 hours per month for every kilowatt of installation. In order to protect the company against increase of installation without notification, Mr. Cowling said that plants were fused so that if the rated capacity was exceeded to any extent the secondary fuse would blow out, and if these were replaced with longer fuses the primary fuse would probably blow out. These safety devices with semi-annual inspection were deemed to be all the protection that was necessary.

Mr. E. H. Rosenquest, president of the Bronx Gas & Electric Company, testified that his company had made no special contracts recently, although two were on the books which had been made when the company was organized. The basing rate for

most of the installations was 12 cents, with a 10-cent rate for hotels and stores. From these terms there is no discount, except that a special arrangement is made for supplying sign lamps at a minimum guarantee of $3 monthly. The company also uses a minimum in its power contracts of $1 per horsepower per month for the motors used.

On Oct. 1, Mr. J. E. Phillips, of the Richmond Light & Power Company, testified that his company had not as yet agreed upon a minimum charge. He said that his company had 45 special contracts with arc light users, almost every one of which was governed by different circumstances and which were charged at different rates. These rates varied from $5 to $7.50 per month per lamp. Mr. Phillips said that his company proposed as soon as possible to do away with these contracts and to sell all current through meters. In the flat rate incandescent contracts, Mr. Phillips said, the company averaged $1 per month for each lamp. He said that four churches are receiving a free supply of current.

Mr. H. E. McGowan, of the Flatbush Gas Company, said that this company had decided to discontinue the requirement of guarantees or minimum charges for retail users; in fact, that the practice had been discontinued Aug. 1. He said that the company had a few special contracts, which were being discontinued as rapidly as possible. The rates of the company, he said, began at 12 cents and were scaled down, according to the consumption, for large consumers. This scaling went so far that one consumer, a large brewery, received current at 7 cents. He said that the company was ready to make standard contracts giving the same opportunities to all consumers. In power contracts, he said, discounts were allowed according to the amount of current used.

Low-Pressure Steam Turbine.

Mr. Chas. B. Burleigh presented a paper at the Saratoga Springs meeting of the National Association of Cotton Manufacturers, held Sept. 29-30, entitled "The Low-pressure Steam Turbine." The author gave some interesting data concerning the performance of two 800-kw Curtis turbines used in connection with reciprocating engines having a combined rating of 8200 hp. The turbines receive steam from a common exhaust-main at a pressure of 1 lb. per square inch above atmosphere and exhaust into a condenser which maintains an average vacuum of 28 in.

The coal consumption for all purposes at this station during the first six months of 1905, before the turbines were installed, averaged 4.48 lb. per kw-hour. The coal consumption for all purposes for the first six months of 1906, after the turbines were installed, averaged 4.08 lb. per kw-hour, showing a saving of 0.4 lb. of coal per hour. As the total output of the station for the first six months of 1906 was 20,346,890 kw-hours, there was a saving of 4069 tons of coal, or 8138 tons for the year, which, at an expenditure of $3 per ton, amounts to $24,414.

It is estimated that the original steam equipment cost $100 per kilowatt, and to have increased the equipment on the original lines would have required an investment proportionately equal to the original investment; the low pressure turbines, with cooling towers, however, were installed at an expense of approximately $50 per kilowatt, and as the turbines are utilizing the energy in the steam previously unused, the fuel consumption has not been increased. In other words, considering a 1500-kw unit operating with one of the 800-kw low-pressure turbines under the new arrangement, 2300 kw were made available at no more expense as regards fuel and attendance than was previously necessary to deliver 1500 kw to the distributing mains. As a matter of fact, the plant has actually delivered 19.5 per cent more energy with approximately 2 per cent less fuel.

Estimates were also given of the economy obtained with a 500-kw low-pressure turbine in a railway generating station at Scranton, Pa., and an 800-kw turbine at East St. Louis.

Convention of Illuminating Engineering Society.

The second annual convention of the Illuminating Engineering Society, which was held in Philadelphia on Oct. 5 and 6, proved highly successful from many points of view. Not only was the attendance of such size as to show that the society is increasing in popularity with the members of the lighting industry, but the character of the papers and the discussion was such as to expel all doubt as to the high standing of the society among engineering bodies. The place of meeting was well selected and the arrangements were admirably carried out. A meeting room, a banquet hall and an exhibition room were provided on the top floor of the Hotel Walton. Founders' Week at Philadelphia proved an excellent time for the convention in furnishing diversion during the few hours when papers were not being read and discussed, but the existence of the Founders' Day exercises detracted somewhat from the completeness in the program of the opening meeting of the convention in that the Mayor of Philadelphia, Hon. John E. Reyburn, was unavoidably prevented from being present. However, an address of cordial welcome was delivered by his secretary, Mr. W. F. Gleason. The total registration up to Monday evening was 261.

Expressions of appreciation having been made by Mr. George Ross Green, as chairman of the general convention committee, and Dr. Louis Bell, as president of the Illuminating Engineering Society, the business portion of the meeting was inaugurated by the presentation of an address by the president. Dr. Bell discussed the principles of street lighting and outlined the defects in the application made of these principles. He remarked that although when man was willing to retire with the animals, the torch and candle were adequate for his demands for incidental lighting to enable him to travel by night from one place to another, he is not now content with primitive sources of light, because he has acquired nocturnal habits. Under present conditions of civilization it is essential to provide permanent illumination for streets, although the amount of light and the arrangement of lighting units are far from being satisfactory. The introduction and evolution of lighting schemes have been along the lines of least resistance, units being selected and installed in accordance with the immediate needs in each case. The result has been poorly-placed lamps and badly-adjusted illumination. A common error has been the attempt to obtain uniformity in lighting equipment over a whole city, when the requirements would dictate the selection of different equipment for different streets of a city. For example, the business streets should be brilliantly lighted, while the outlying streets need be lighted to only an extent that will enable a person to travel safely from place to place. In any event, it is improper to use large lighting units spaced at great intervals, a far better plan being to install many small units distributed at closer intervals along the street. The business streets should be so lighted as to enable a person to read ordinary print without the aid of other illumination. In London the value of 0.25 foot-candle is common for business streets. In many of the foreign cities use is made of diffusing globes which are seldom employed here.

Dr. Bell expressed his dislike for the American method of determining the light from a street lamp by observing the illumination on a normal plane, and stated that it is much better to measure the illumination on the horizontal plane. The use of the latter method for specifying the minimum illumination between lamps, rather than the former, would tend to improve the standard of street lighting in this country.

Dr. Bell also criticised the so-called "moonlight schedules" of lighting in use in this country, as allowing too low a value for the illumination. Moonlight is frequently assumed to have a value of from 0.01 to 0.02 foot-candle; at full moon such a value may exist, but at one-half moon probably not more than one-tenth of this value is given. Moreover, it is incorrect to compare the illumination obtained from moonlight with that

given by artificial illuminants, because the diffusion is much greater with moonlight. He stated that it is far better to operate the lamps on a one-half night lighting schedule rather than on the moonlight schedule.

The need at the present time is for more light much better diffused and lamps more closely spaced, especially along business streets. In obtaining these results the old types of gas and electric lamps must be abandoned and the high-efficiency units must be employed. When this plan has been carried out, it will be found that the cost for lighting has not been increased.

The second and last paper on the program for the opening session was the report of the committee on nomenclature and standards, which in the absence of the chairman, Dr. A. C. Humphreys, was abstracted by Dr. Hyde.

Neither Dr. Bell's address nor the report by Dr. Humphreys was discussed.

At noon on Monday luncheon was served by the convention entertainment committee at Hotel Walton, after which the military and naval parade in connection with Founders' Week celebration was viewed from places of vantage.

Abstracts of the papers presented at the evening session on Monday and the morning and afternoon sessions on Tuesday are given below.

STANDARD OF LIGHT.

Dr. A. C. Humphreys as chairman of the Committee on Nomenclature and Standards reported the progress already made in the direction of establishing a common national and international unit of candle-power. During the past year subcommittees representing the American Institute of Electrical Engineers, the American Gas Institute, and the Illuminating Engineering Society adopted resolutions recommending that the Bureau of Standards at Washington maintain as the standard unit of light a candle 2 per cent less than that now maintained at the Bureau, pending the adoption of an international unit. The temporary unit suggested represents approximately an average of the candle units now maintained at the national laboratories of the United States, England and France. Moreover, it is roughly the average of the values used in this country for the standard candles in the photometry of gas and electric lamps, the gas industry employing a standard candle 4 per cent lower than that used by the electrical industry. This action has been endorsed by the Council of the Illuminating Engineering Society and by the Board of Directors of the American Institute of Electrical Engineers, and the resolutions will be presented for approval by the American Gas Institute at its annual convention to be held in October, 1908.

GAS LIGHTING CONVENIENCES.

In a paper entitled "Modern Gas Lighting Conveniences," Mr. T. J. Little, Jr., outlined the various schemes that are used for igniting gas lamps. In addition to the "pilot-flame" method mention was made of the various electric ignition methods, including those employing jump-spark igniters, automatic electric igniters and pendant electric igniters. The author stated that self-contained mantle gas-lighting units can now be obtained that consume only 1.7 cu. ft. per hour while giving 51 cp.

THE ILLUMINATING VALUE OF PETROLEUM OILS.

Dr. A. H. Elliott read a paper reporting the results of tests conducted with various types of lamps using petroleum oils. The tests were undertaken with the object of obtaining a secondary standard of light for photometric work. The experiments showed that the light from a certain type of lamp varied by less than 1 per cent during seven hours. No attempts at ascertaining the degree of reproducibility were recorded, effort seemingly having been concentrated on obtaining a steady flame burning at a uniform rate and giving a constant candle-power.

STREET LIGHTING.

Mr. H. Thurston Owens read a paper dealing with street lighting in retail business districts, wholesale business districts, residence streets in residence districts, prominent thoroughfares in residence districts and outlying country roads. Mention was made of the various types of gas and electric lamps that are suitable for use in the above localities. The author entered a plea for dignified and artistic designs of street lighting fixtures and lamp-posts.

STRUCTURAL DIFFICULTIES IN INSTALLATION WORK.

In a paper entitled "Structural Difficulties in Installation Work" Mr. James R. Strong expressed the opinion that in designing the circuits for an office building the best method is to consider each floor as a whole, bearing in mind the class of tenants who would be likely to occupy an office in the neighborhood where the building is located. The outlets for general illumination should be placed on the center line of windows and other outlets should be placed around the ceiling a short distance inside the lines of partitions. By this method no changes will be required when the building is rearranged for another tenant.

ARCHITECTURE AND ILLUMINATION.

In a paper by Mr. Emile G. Perrot, illumination was considered under two heads, necessary lighting and decorative lighting. Under the first head are included all methods of lighting which are used in buildings irrespective of the effect upon the architecture. The second division comprises the use of artificial lighting for the purpose of display without any reference to the scientific or economic aspect. The author stated that in many instances the former method of lighting seriously counteracts the effect of architecture by compelling the use of large and unsightly fixtures in locations ill adapted for them and claimed that the architect should design the fixtures of a building just as he designs the carving for a column capital. He suggested the publication by the Illuminating Engineering Society of tables embodying standards and giving data and formulas for the lighting of all types of buildings by the various illuminants, in order to keep the architect in touch with all that is new and desirable for the purpose of effectively and economically lighting the buildings he designs.

THE INTENSITY OF NATURAL ILLUMINATION.

Mr. Leonard J. Lewinson presented a paper dealing with the intensity of illumination produced by natural sources of light, such as the sun, the moon and the stars, modified by the earth's atmosphere. As a result of tests conducted during August and September, 1908, in New York, the author concluded that daylight illumination varies in intensity from 2000 to 8000 foot-candles, between the hours of 8 a. m. and 4 p. m. Certain cloud formations have the effect of increasing the intensity of illumination by diffusion. Other clouds act as absorbing media, and decrease the illumination intensity. Variations in intensity due to clouds, are often of a large order, and sometimes occur suddenly. In the absence of clouds, the rate of change of intensity, between the hours of 8 a. m. and 4 p. m. is regular. The rate of change of intensity during the hours of dawn and twilight, is very high. The skylight value at night, when there is no moon, is approximately .001 foot-candle. The intensity of moonlight is about .014 foot-candle.

THE INTEGRATING PHOTOMETRIC SPHERE.

A paper by Dr. Clayton H. Sharp and Mr. Preston S. Millar dealt with the theory and operation of the integrating sphere as used in industrial photometry. The integrator consists of a hollow sphere containing the source of light, and coated on the inside with a white diffusing paint. Into the side of the sphere is set a small window of diffusing glass, the brightness of which, when the direct rays of light are screened from it indicates the total luminous flux within the sphere. The sphere possesses the following advantageous features: Simplicity of construction; no adjustment of parts required; absence of flicker due to rotation of lamp; elimination of breakage due to rotation of lamp; may be used in a light room where necessary; higher accuracy than other integrating photometers.

COLORIMETER MEASUREMENTS.

Dr. Herbert E. Ives presented a paper describing a colorimeter designed by Mr. Frederic E. Ives and outlining the results of certain tests made with this instrument. When the apparatus is properly arranged the light from any illuminant can be measured and compared with that from any other. For example,

giving to the red, green and blue lights in white light separately arbitrary values of 100, the light from a gas flame is found to be $r = 30.7$, $g = 38.7$ and $b = 19$; the light from a Nernst glow has corresponding values of 44.7, 71.7, and 56.3.

The accompanying table gives the results of a set of measurements on 21 different sources of light, expressed in terms of average daylight as observed during an interval of three weeks:

Colorimeter Readings on Various Sources.

Source	Red	Green	Blue
Average daylig't	100	100	100
Blue sky, mean of five sets	100	106	120
Overcast sky, mean of four sets	100	92	85
Sunlight, 2 p. m., August 19th	100	95	68
Sunlight, afternoon observations, 2 to 5 p. m.	100	91	56
Nichols' average daylight (acetylene flame and A. O. Co. blue glasses 5 and 1)	100	69	42
Carbon arc, direct current	100	64	39
Mercury vacuum arc (Cooper Hewitt)	100	130	190
Moore carbon dioxide tube	100	120	520
Welsbach mantle, 1¼ per cent cerium	100	81	28
Welsbach mantle, 2¾ per cent cerium	100	69	14.5
(Mantle preferred by Welsbach Co. for residential illumination)			
Welsbach mantle, 3¼ per cent cerium	100	63	12.3
Tungsten lamp, 1.57 watts per mean spherical c. p.			
Tungsten lamp, 1.25 watts per mean horizontal c. p.	100	55	12.1
Nernst glower, bare, 118 volts, .4 ampere	100	51.5	11.3
Acetylene flame	100	50	10.4
Tantalum lamp, 2.5 watts per mean spherical c. p.			
Tantalum lamp, 2.0 watts per mean horizontal c. p.	100	49	8.3
Graphitized filament, 3.1 watts per mean spherical c. p.			
Graphitized filament, 2.5 watts per mean horizontal c. p.	100	48	8.3
Glow lamp, 3.9 watts per mean spherical c. p.			
Glow lamp, 3.1 watts per mean horizontal c. p.	100	45	7.4
Flaming arc	100	36.5	9
Helium tube	100	37.0	9
Gas flame, open fish-tail burner	100	40	5.8
Moore nitrogen tube	100	28	6.6
Hefner	100	35	3.8

CALCULATING AND COMPARING LIGHTS FROM VARIOUS SOURCES.

Mr. Carl Hering presented a paper containing 27 formulas arranged so as to clarify the apparent mistiness surrounding many of the calculations of light. Each formula was explained in simple terms in order to show the real physical meaning of the various quantities involved. Accurate definitions were given of the terms "flux," "intensity" and "illumination." The fundamental differences between the formulas for the radiations from a point, a line and a surface source were thoroughly explained. He showed that the illumination produced at any place by a theoretical point of light varies inversely as the square of the distance to that place, while for a theoretical line of infinite length it is inversely as the distance and for a theoretical surface of infinite extent (such as the sky) it is independent of the distance, being the same everywhere in space. Attention was called to the errors that are frequently made in photometering the light from a lamp equipped with a large reflector when the measured candle-power in a certain direction at a certain distance is stated as being the real output in light when it is merely an equivalent candle-power. When the candle-power value is given, it is essential to state the distance else the value is meaningless.

FLUX OF LIGHT.

A paper by Messrs. J. R. Cravath and V. R. Lansingh discussed the flux of light method of calculating illumination, and showed its practical application to engineering problems. After giving the definition of the lumen as the amount of light falling on a surface 1 ft. square when it is evenly illuminated to an intensity of 1 foot-candle, the authors showed that 1 spherical candle produces 12.6 lumens. This constant allows one to ascertain the amount of light flux upon a certain area when the number of candles is known and all light reaches the area, and thereby to determine the foot-candle value of illumination on the area. It is stated that lamps consuming 1.25 watts per horizontal candle-power require 0.25 watt per square foot to produce an average illumination of 1 foot-candle when equipped with either bowl on concentrating prismatic reflectors. The consumption would be twice as great with lamps consuming 2.5 watts per candle, and about 2.5 as great for 3.1-watt lamps. From the fact that a value of 0.50 watt per square foot is required for a 5-amp direct-current enclosed arc lamp it would seem that the specific consumption of this lamp is about equal to that of the 2.5-watt graphitized-filament lamp.

STREET LIGHTING WITH GAS IN EUROPE.

Mr. E. N. Wrightington presented a paper outlining the types of gas lamps used for street lighting in Europe. The most striking feature is the use of high-pressure inverted gas lamps, giving as high as 3600 mean lower hemispherical candle-power. Use is made of smaller inverted mantle lamps for which there is claimed a specific output of from 30 to 40 cp per cubic foot of gas consumed per hour under low pressure, and from 50 to 60 cp with high-pressure gas.

ILLUMINATION OF LIBRARIES.

Mr. L. B. Marks presented a paper describing in detail the lighting equipment of the new Carnegie Branches of the New York City Public Libraries, and reporting the results of tests of the illumination obtained.

PROBLEMS IN ILLUMINATION.

A paper by Mr. Alfred A. Wohlauer discussed engineering problems in illumination, particular attention being paid to methods for obtaining uniform illumination. A solution of the problem of designing a reflector to produce uniform illumination by the use of a point source and mirror reflecting surfaces is outlined.

THE INTRINSIC BRIGHTNESS OF LIGHTING SOURCES.

Mr. J. E. Woodwell presented a paper emphasizing the importance of intrinsic brightness as a factor in practical illumination. He summarized the hygienic effects of light sources of high intrinsic brilliancy within the field of vision as follows:

(1) Contraction of the pupil is caused, thereby reducing the amount of light entering the eye and the consequent visibility. (2) The sensibility of the visual organs is temporarily impaired by residual images and retinal fatigue. (3) The effects of (1) and (2) are also produced by the occasional view of bright sources or by subjecting the eye to sudden fluctuations of light. (4) Intrinsic brightness rather than the distance of the source from the eye is the principal cause for pupillary contraction. (5) The harmful effects are greatest in proportion to the decrease in the working illumination and are considerably reduced under an illumination exceeding 2 foot-candles. (6) The different luminous sources may be classed with reference to producing pupillary contraction and after-images in the same order as their respective intensities.

The author stated that the mean annual brightness for zenith sky at Chicago has been found to be 3.47 candles per square inch. Shades and screens are used to reduce the illumination within a room to as low as 0.1 cp per square inch. Even an abnormally high illumination of 10 foot-candles on a white diffusing surface, such as white blotting paper, gives an intrinsic brightness of the surface very little more than 0.005 cp per square inch.

Compared with the above figures the intrinsic brightness of all of the naked artificial luminous sources is enormously high, while the values secured in actual practice by the use of shades and diffuse reflecting surfaces are generally more than 10 times as great. A number of authorities regard 5 cp per square inch safe and admissible and 1 or 2 cp good practice. While the use of even the lower of these values in artificial illuminations is questioned, it would result in a most pronounced improvement from the hygienic standpoint and alleviate one of the principal causes of eye strain and fatigue. Acid-frosted or sand-blasted incandescent carbon or graphitized filament lamps as commonly used in exposed positions without reflectors have an intrinsic surface brightness of from 0.75 to 1.0 cp per square inch. When in the field of vision, however, such frosted lamps frequently produce a most distressing and harmful result, and reduce the value of the effective illumination.

In consideration of the foregoing data, as well as from actual experience in the design of illumination, the author expressed the opinion that from 0.2 to 0.1 cp per square inch is none too low for the safest and best practice where artificial sources must necessarily be placed in the constant or even occasional field of vision.

REFLECTIONS FROM WALLS, CEILINGS AND FLOORS.

A paper by Messrs. V. R. Lansingh and T. W. Rolph contained a report of some experiments relating to the reflection of light from ceilings, walls and floors under average conditions of artificial illumination. When a bare lamp was used in the center of a room 24 ft. long, 11.5 ft. wide and 11 ft. high, it was found that the illumination on the reading plane was increased by 79 per cent when the ceiling was changed from dark to light color; there was a total increase of 132 per cent when both the ceiling and walls were made light in color. When a prismatic reflector was placed on the lamp, all other conditions remaining the same, the illumination with dark ceiling, floor and walls was increased from 0.19 foot-candle to 0.36 foot-candle, but the increase by changing the color of the ceiling from dark to light was only 33 per cent, and the total increase when both the ceiling and the walls were made light in color was only 56 per cent. Thus, the illumination with light walls and ceiling was 0.56 foot-candle with the bare lamp, and 0.63 foot-candle when the reflector was used.

RELATION BETWEEN CANDLE-POWER AND VOLTAGE OF DIFFERENT TYPES OF INCANDESCENT LAMPS.

A paper by Mr. F. E. Cady reported the results of tests made upon numerous types of incandescent electric lamps in order to ascertain the relative change in candle-power with a change in the impressed voltage. The tests showed that relation between candle-power P and voltage E, can be expressed as an exponential equation $P = aE^k$, the value of the exponent k depending upon the type of lamp and the specific consumption at which it is operated. The factor a evidently has a value depending upon the normal electromotive force and candle-power of the lamp. The accompanying table gives the values observed for the exponent k for various commercial types of lamps.

VALUES OF k FOR DIFFERENT FILAMENTS AT ORDINARY SPECIFIC CONSUMPTION.

Type of Filament.	Watts per mean horizontal candle.	Watts per mean spherical candle.	Exponent k
Untreated Carbon	4.0	4.85	6.6
Treated Carbon	3.1	3.76	5.4
Gem	2.5	3.12	4.0
Tantalum	2.0	2.50	4.0
Osmium	1.5	1.85	3.8
Tungsten	1.25	1.56	3.6

It will be noted that the exponent for the change of candle-power with change of voltage is a function of the watts per mean spherical candle-power, decreasing as the specific consumption decreases.

Gas Ownership of New York Electric Lighting Plants.

The first annual report of the New York Public Service Commission, First District, covering the six months ended Dec. 31, 1907, shows the intercorporate relationships of the various electrical and gas corporations under the jurisdiction of the commission. The report shows that the entire supply of gas and electricity in Manhattan and the Bronx is controlled either directly or indirectly by the Consolidated Gas Company, which also controls the Consolidated Telegraph & Electrical Subway Company, the corporation which owns the ducts for high-tension distribution. The Kings County Electric Light & Power Company, which is controlled by the New York lighting interests, in turn controls the Edison Electric Illuminating Company of Brooklyn and through it the Amsterdam Electric Light & Power Company. Figures showing the intercorporate ownerships affecting the various properties are given. The Consolidated Gas Company owns the entire outstanding $500,000 capital stock of the Astoria Light, Heat & Power Company's $45,041,000 of the $45,051,000 outstanding stock of the New York Edison Company; $1,641,800 of the $1,649,500 outstanding preferred stock of the United Electric Light & Power Company; $3,654,000 of the $3,697,100 outstanding common stock of the United Electric Light & Power Company, and the entire outstanding $2,500,000 preferred and $10,000,000 common stock of the Westchester Lighting Company. The Edison Electric Illuminating Company of Brooklyn owns $487,800 of the $500,000 stock of the Amsterdam Electric Light, Heat & Power Company. The Kings County Electric Light & Power Company owns the $5,000,000 outstanding stock of the Edison Electric Illuminating Company of Brooklyn. The New York Edison Company owns $1,658,000 of the $3,000,000 outstanding stock of the Consolidated Telegraph & Electrical Subway Company. The United Electric Light & Power Company owns $999,000 of the $1,000,000 outstanding stock of the Brush Electric Illuminating Company.

The New York Electrical Show.

The New York Electrical Show commemorating also 50 years of transatlantic communication by cable and the passage of the first quarter of a century of electrical service in New York, was opened with fitting exercises on Saturday evening, Oct. 3. Two-minute phonographic speeches were made by Mr. Thomas A. Edison, president of the show; Mr. Louis A. Ferguson, president of the A. I. E. E.; Mr. William C. L. Eglin, president of the N. E. L. A.; Mr. W. W. Freeman, president of the Association of Edison Illuminating Companies; Mr. E. G. Acheson, president of the American Electrochemical Society; Mr. Henry A. Lardner, president of the New York Electrical Society, and Hon. Charles E. Hughes, governor of the State, the speech of the latter prefacing the opening of the show.

The arena where the exhibits are housed is brilliantly illuminated with myriad tungsten lamps and flaming arc lamps. The exhibitors have strived to achieve an impressive general effect, and they have succeeded. In the north gallery are exhibits of historic character dealing with the first attempts made in 1858 to lay a telegraph cable across the Atlantic Ocean and with the subsequent work done in ocean telegraphy, covering a period of 50 years. An interesting historical lighting exhibit illustrates the evolution of electric lighting since 1882 and shows the various types of apparatus used at the various stages of development and improvement. An electrochemical exhibit illustrates broadly the application of electricity in the chemical arts and in the treatment of metals. The exhibits in this section comprise working electric furnaces and electrochemical products.

In order to afford the public an intimate understanding of the workings of wireless telegraphy, wireless bulletins are transmitted from the tower of the Times Building to the Garden twice every day of the show. Each bulletin contains about 200 words and embodies in condensed form the news of the day up to the time of transmission. After the messages are typewritten by the Marconi operator, they are put in type on a linotype machine of latest construction and then printed in the daily paper which is distributed gratuitously to the spectators. In the basement of the Garden a number of electrical devices and appliances for farm and agricultural work are shown. The electric cow milking machines are, of course, a center of attraction.

During the week a series of lectures will be delivered in the concert hall. Mr. Sidney W. Ashe is scheduled for lectures on electric lighting, electric railways and electrical measurements. Mr. Max Lowenthal is scheduled for two lectures on hydro-electric power generation, transmission and utilization, and electric light, heat and power in home and factory. Mr. F. A. Collins is scheduled for lectures on wireless telegraphy and wireless telephony. On Monday night, Oct. 12, Mr. William Maver will lecture under the auspices of the New York Electrical Society on the "Dramatic Phases of the Early Cable Work," and there are other lectures to be given which are not scheduled as yet. There will also be many conventions during the show. The Rejuvenated Sons of Jove will hold their convention on Oct. 10, and a gathering of members of the Empire State Gas & Electric Association took place during the week. On Thursday an informal congress of specialists interested in the cure of tuberculosis was held and the receipts from admissions on that day were donated to the Loomis Sanatorium at Liberty, N. Y. On Tuesday, Oct. 13, the New York Edison

Company will give a smoker to the electrical contractors of the city.

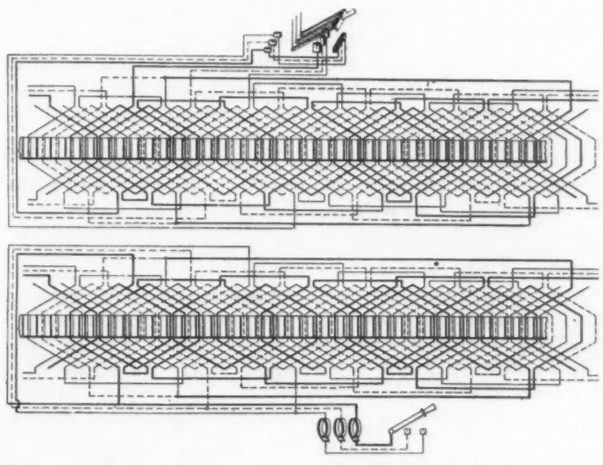
A feature of the show is the predominance of tungsten lamps, the carbon filament lamp being conspicuous by its absence. The tungstens are shown from the smallest to the largest lamps built. The Edison Electric Illuminating Company of Brooklyn and the United Electric Light & Power Company have interesting and comprehensive displays. The latter company's handsome booth is filled with working exhibits of alternating-current apparatus, while that of the Brooklyn Edison Company is divided into three sections; one section showing the industrial application of electricity, another, the commercial application, and the third, the domestic applications. Detailed descriptions of these booths will be published next week. The New York Edison Company erected a magnificent booth in the center of the arena which is devoted solely for the entertainment of its patrons and guests. A description of the other exhibits is given elsewhere in this issue. The attendance during the first few days was not equal to the attendance during the same days last year. This was to be expected in view of the fact that free tickets were not distributed this year. The show is comfortably crowded, however, and visitors have a better opportunity to see and examine the exhibits this year than was the case last year. The show closes on Oct. 14.

Improvements in Alternating-Current Motors.

Four patents issued on Sept. 1 relate to improvements in alternating-current motors of the induction, synchronous, series-commutator and series-repulsion types.

ADJUSTABLE-SPEED INDUCTION MOTOR.

A patent granted to Mr. E. F. W. Alexanderson discloses an induction motor that may be operated at three different speed ranges. The motor is provided with two separately-insulated primary windings arranged for different numbers of poles, and for two separately insulated secondary windings, each having the same number of poles as one of the primary windings. With the motor thus arranged, by connecting one primary winding to the source of energy and short-circuiting the secondary winding having the same number of poles, a certain speed is obtained; when the windings having a different number of poles



FIGS. 1 AND 2.—PRIMARY AND SECONDARY WINDINGS OF THREE-SPEED MOTOR.

are similarly used, a second speed is obtained. A third speed is obtained by joining one primary to the source, connecting the two secondaries together and short-circuiting the other primary winding.

The operation when the motor is thus connected will be understood by considering the inductive effects of the several windings upon each other. Since the two secondary windings have different pole numbers, the primary winding that is connected to the source can produce a resultant e.m.f. only in the secondary winding having the same number of poles, and the current, supplied from this secondary winding to the other, produces a resultant e.m.f. and current only in the second primary winding which is short-circuited. The motor consequently acts precisely like two motors connected in concatenation, and the speed of the motor is the same as that of an ordinary motor having a number of poles equal to the sum of the number of poles of the two primary windings. The arrangements of the windings are shown in Figs. 1 and 2. Each member is provided with distributed uniform coils so that both

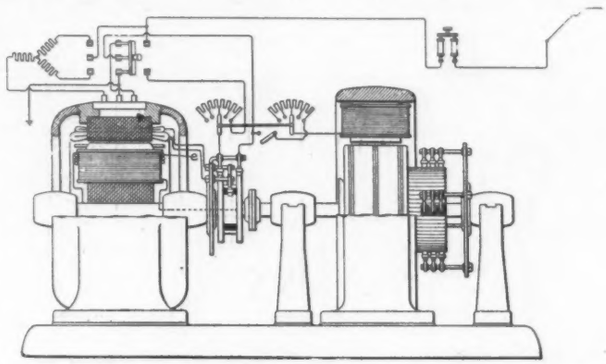


FIG. 3.—SELF-STARTING SINGLE-PHASE SYNCHRONOUS MOTOR.

windings, although connected for different pole numbers, have the same coil width, and are interlaced to form mechanically a single winding in every way identical with a standard single-speed induction motor winding.

SELF-STARTING SINGLE-PHASE SYNCHRONOUS MOTOR.

Fig. 3 illustrates a second patent granted to Mr. Alexanderson on the same date. The machine is a single-phase synchronous motor arranged for driving a direct-current generator. The synchronous machine is started from rest as a split-phase motor. The rotary-field core is provided with two windings displaced circumferentially by 90 electrical space-degrees, which during starting are connected to the supply system through phase-splitting devices so that a revolving magnetism is produced on the field core. The stationary armature winding being short-circuited upon itself, the rotor accelerates to full speed by induction motor action. For improving the starting torque, the armature coils are arranged as a star-connected three-phase winding. One of the three armature windings is idle when the motor is running. However, during running conditions the three-phase e.m.fs. counter generated in the armature coils are used for supplying exciting current through a rectifying commutator to both the synchronous motor and the direct-current generator. This method of excitation was outlined in our issues for May 20, 1905, Feb. 3 and Feb. 10, 1906. The equipment has been designed for use with motor-generator locomotives receiving energy from a single-phase system and employing direct-current motors for propulsion. See also page 335 of the ELECTRICAL WORLD for Feb. 15, 1908.

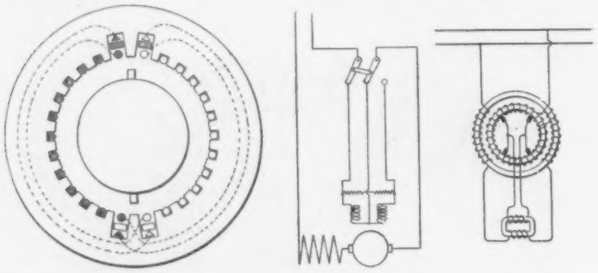
SINGLE-PHASE COMMUTATOR MOTOR.

Mr. Marius C. A. Latour obtained a patent for a single-phase commutator motor so operated that the field windings perform the double duty of producing the main field flux and the compensating flux. The usual arrangement of coils on a compensated series single-phase motor is illustrated in Fig. 4, where the conductors of the compensating windings are shown as circles, the main field coils as rectangles and the commutating coils as triangles. A study of the direction and magnitude of the field-coil and commutating-coil currents in each slot shows that the resultant current in each slot is equal to that in each of the other three slots, and that it is displaced in time-phase by exactly 180 deg. from the current in one other slot. The inventor proposes to so connect the coils together that a single resultant current of proper value and magnitude may be used in a single coil in each pair of slots. The arrangement to be used is shown diagrammatically in Fig. 5. By means of a phase-splitting arrangement the current in the main field coils for

adjacent poles are displaced in time-phase. The magnetism in the commutating lug is produced by a m.m.f equivalent to the vector difference between the currents in the adjacent field coils. This magnetism is partly in time-quadrature to the main field flux and hence assists in preventing sparking.

REPULSION MOTOR.

The arrangement of single-phase commutator motor windings shown in Fig. 6, forms the subject of a patent issued to Mr. Maurice Milch upon an application filed Oct. 12, 1903. The primary winding is distributed over only a portion of the



FIGS. 4, 5 AND 6.—SINGLE-PHASE COMMUTATION MOTORS.

stator core and the secondary brushes are so located as to short-circuit only those portions of the rotor windings that are adjacent to the primary windings, the idle portion of the secondary being utilized for producing an auxiliary field along the inactive portion of the stator core. It is claimed that the magnetic leakage is rendered a minimum by this arrangement, while the commutation is improved.

The above four patents have been assigned to the General Electric Company.

Investigation Into Economic Power & Construction Company.

The New York Public Service Commission, Second District, began at Buffalo, Oct. 2, an investigation into the affairs of the Economic Power & Construction Company. This company asserts the right under its charter to transact business without compliance with the requirements of the Public Service Commissions law. At the preliminary hearing at Buffalo it was shown that of the total $50,000 stock of the company, $48,500 was issued for patents and $1,500 for cash. All but three shares of the stock are owned by the New York Power Securities Company, which also denies that the commission can exercise jurisdiction over its affairs.

CURRENT NEWS AND NOTES.

TAX ON GAS AND ELECTRICITY.—Germany is under the necessity of devising new taxes, and it has been intimated that gas and electricity would come within the scope of the new schedules. Herr Sydow, secretary of the Imperial Treasury, has just made a formal announcement as to the new taxes, but neither gas nor electricity is mentioned.

EIGHT-HOUR LAW UNCONSTITUTIONAL.—At Madison, Wis., on Sept. 29, the Supreme Court declared unconstitutional the Wisconsin eight-hour railroad telegraphers' law, which was enacted at the 1907 session of the Legislature. The law is declared unconstitutional on the theory that it is in conflict with provisions of the Federal Constitution.

THE CABLE IN POLITICS.—The official gazette of Venezuela has published the decision of the Court of First Instance against the French Cable Company, with damages of nearly $5,000,000 awarded against the company because of aid alleged to have been given to the insurgent chief, General Matos, to whom news was furnished at the time of his struggle for supremacy with President Castro, who now has the cables, but can get no one to take the risk of making connection with them.

TELEGRAPHERS' MUTUAL BENEFIT ASSOCIATION A BENEFICIARY.—The will of Emma A. Tillotson, widow of L. G. Tillotson, which was filed Sept. 29, bequeaths $5,000 to the Telegraphers' Mutual Benefit Association. Among the many other institutions which receive like bequests are the American Master Mechanics' Association and the Master Car Builders' Association. L. G. Tillotson, who died in January, 1885, was a prominent manufacturer of electrical and railway supplies in New York.

TRUNK LINE ELECTRIFICATION.—The *Electric Trunk Line Age*, published monthly by Muralt & Company, 114 Liberty Street, New York, has concluded its volume. While this journal is published to advance the interests of a particular system of trunk-line traction, it has during the year contained some interesting studies of the electrification of sections of certain trunk lines, accompanied by estimates in detail of costs. The September issue concludes an article on the electrification of the mountain division of the P. & U. Railroad.

A. I. E. E. CATALOGUE OF WHEELER GIFT.—The bibliographical catalogue of the books, pamphlets and periodicals of the celebrated Latimer-Clark collection presented by Dr. Schuyler Skaats Wheeler to the American Institute of Electrical Engineers, has just been completed and is about to go to press. This critical catalogue has been in preparation for the past six years under the direction of Mr. W. D. Weaver, with the collaboration of Brother Potamian, of Manhattan College, and a number of other authorities here and abroad. The expense of this unique work has been defrayed by Mr. Andrew Carnegie. As soon as the book comes from the press, it will be distributed to the members of the Institute.

NEW YORK ELECTRICAL SOCIETY.—The opening meeting of the New York Electrical Society for the season 1908-09 will be held in the concert hall of Madison Square Garden, Monday, Oct. 12, at 8:30 p. m. Mr. William Maver, Jr., will give a half-hour address on "Dramatic Phases of the Early Cable Work." A succinct account will be given of the early progress in submarine cable laying, leading up to the making and laying of the cables of 1858 and 1866. The address will be illustrated by lantern slides, showing some of the incidents of these historical events, and the prominent engineers identified with them. Through the courtesy of the management of the Electrical Show the members of the society are invited to attend the show after the meeting, without charge. The members are also invited to visit the headquarters of the society, in the northeast corner of the building.

NEW YORK FREIGHT SUBWAY.—A plan has been submitted to the Public Service Commission of the First District of New York by the Amsterdam Corporation, of which William J. Wilgus, former vice-president of the New York Central & Hudson River Railroad, is the president, for the construction of a four-track, electrically operated freight subway to encircle the lower end of Manhattan Island. The plan is to connect with the New York Central & Hudson River freight tracks at Sixtieth Street and the North River, run thence south along the North River to the Battery and thence north along the East River to a connection with the New York, New Haven & Hartford Railroad in the Bronx. A crosstown line below Forty-second Street to connect the east and west lines would form a complete circuit and connect by tunnel under the Hudson River with a freight classification yard back of the Bergen Hills in New Jersey, where the freight could be assembled and handled by the railways terminating on the Jersey side of the river. The belt line would be built beneath the sidewalks of the business district of Manhattan and connected by high-speed routes with the principal rail and water carriers.

Hydro-Electric Generating Station of the Inland Empire System.

A LARGE hydro-electric generating station has just been completed by the Spokane & Inland Empire Railroad Company at Nine-Mile Bridge, below Spokane, on the Spokane River. The power plant is connected with the railroad company's distribution center in Spokane by a new high-tension transmission line. The site on which the plant is built is about 13 miles distant from Spokane, where the river passes through a granite rock canyon. The new plant on July 26 began supplying energy to the Spokane & Inland Division of the Inland Empire System. This division comprises about 130 miles of well-built track with cars and locomotives fed from a catenary supported trolley distributing single-phase current. The new plant also furnishes energy for lighting the town of Rosalia, Wash., and by the attendant increase in generating equipment the company is in a position to sell additional energy at several points along its lines.

GENERAL FEATURES OF DEVELOPMENT.

The method selected for this development was to dam the river at a point in the canyon, using the power house as a part of the water-stop. The power house was placed in the deepest part of the river against the west bank and a water-stop wall at a proper elevation was extended up the west bank. The dam proper was placed between the power house and the east bank. The location of the dam on the east side was selected because the river was shallowest on this side; indeed, at very low water the rock foundation was above the water level. The west side was selected for the power house, for the reason that, being the deepest part of the river, the river section made a natural tail race for the water. The length of the pond or lake formed by the 58-ft. dam is 5.1 miles, as measured by the river center line.

Sanderson & Porter, New York, were employed as constructing and designing engineers and William F. Zimmermann was

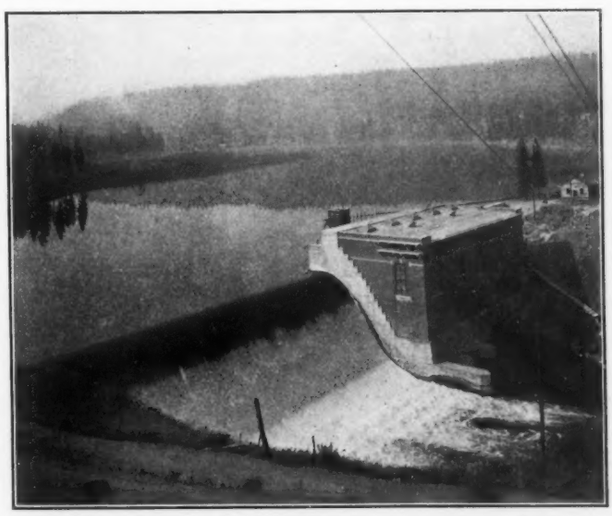


FIG. 1.—GENERAL VIEW OF NINE-MILE HYDRO-ELECTRIC PLANT.

employed as consulting engineer. F. M. Sylvester was engaged by Sanderson & Porter to act as local manager and he had immediate charge of the construction work.

WATER CAPACITY OF SPOKANE RIVER.

A careful study showed that the average flow of the river could be maintained at 2100 cu. ft. per second, as noted by the Spokane River gagings, therefore it was decided to install four units of 5000 hp each, nominal rating, so that three of these units could be operated at any one time and the fourth unit could be kept in reserve. This would afford a peak-load of about 15,000 hp, or for a three-hour to five-hour run the plant could easily carry 18,000 hp, provided the daily load factor was not over 60 per cent, the overload rating of units being based upon the output of the water wheels rather than the output of the generators. The water wheels attached to each unit will generate under a 58-ft. head 6850 hp, which, allowing 93 per cent efficiency for the generators, and with the transformer and wiring losses, means an electrical output from the station of 6000 hp per unit.

From these quantities it can readily be seen that under normal working conditions the rating of this plant for maximum loads, using a 60 per cent daily load factor, is conservatively estimated at 15,000 hp, and that the plant actually will carry a load of

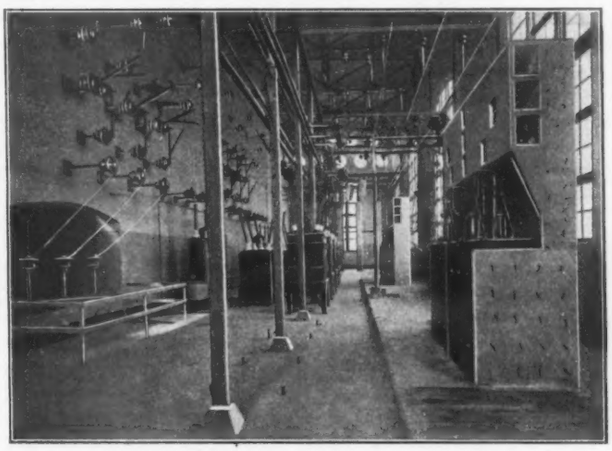


FIG. 2.—HIGH-TENSION ROOM.

between 17,000 hp and 18,000 hp; while if the daily load factor is as high as 70 per cent, the plant will carry 15,000 hp at the peak-load periods.

In making the above estimates everything has been based on the Government gage readings at Spokane. The plant, however, is located about 15 miles, as the river runs, below this gaging station and additional water comes into the river between the gaging station and the power plant. This extra flow appears to be not less than 300 cu. ft. per second.

DAM.

The dam is built of what is known as cyclopean masonry; large blocks of granite rock well washed before going into the work were placed on the concrete and wet concrete slushed and well tamped around them, no two pieces of stone being allowed to touch. Before beginning the construction of the dam, the surface of the granite rock river bottom, on which the dam rests, was excavated and all the soft or imperfect rock removed. A trench about 6 ft. x 6 ft. extending the full length of the dam was excavated under the upstream face of the dam; this was filled with concrete and forms a water stop, and a 6-ft. step was left at the downstream side, against which the dam rests and which would effectually prevent any downstream movement. Between the downstream excavation and the upstream trench, these two points representing the width of the dam, the surface was left saw-toothed so as to offer the greatest possible bond for the concrete and assist in making the lower bond of the dam to the rock impervious to water. The upstream face of the dam is nearly vertical and the downstream face, or watershed, is S-shaped, giving the water a horizontal discharge about 4 ft. above the bedrock.

The dam is separated from the power house by an expansion joint; there are also two expansion joints in the dam proper, about 70 ft. apart, and pitch is used in the joints to prevent seepage. The dam is well drained, vertically and horizontally, drains being placed near the upstream face, which drains lead to the main drain, discharging at the downstream foot of the dam. These drains will take any water that comes through the face of the dam and give it a natural outlet and thus relieve the dam from any floating effect due to water.

The principal dimensions of the dam are: Length of spill-

way, 225 ft.; height above tail race, low water, 58 ft.; width at the bottom, 66 ft. 6 in., and area of section, 323 sq. yd.

MACHINERY.

The turbines are Hercules water wheels fitted with wicket balance gates and were built by the Holyoke Machine Company, Worcester, Mass. There are two turbine units, each unit consisting of four 42-in. wheels mounted on a horizontal shaft and arranged in pairs, with a central discharge draft tube for each pair. Each unit is capable of developing 6850 hp at full gate openings with 58 ft. head and 5500 hp at 50 ft. head when operating at a speed of 240 r.p.m. The main shaft on which the first set of runners is attached is coupled direct to the generator shaft, passing through a stuffing box in the bulkhead between the dynamo room and the turbine chambers. This shaft is 11 in. in diameter at the generator end, 35 ft. 1½ in. long and is made of nickel steel. Although the turbine runners are rights and lefts and, therefore, are balanced, there is a thrust bearing just outside of the bulkhead to take up any inequalities that there may be between the pairs of turbines. To this main shaft is coupled a second shaft, on which are the second set of runners; this shaft is 9 in. in diameter and 20 ft. 2 in. long. The runners operate in cast-iron cases and the shaft carrying the runners is supported by journals, one at each end of the casing, and a center bearing supported from the top half of the casing; the thrust bearing forms the support for the main shaft at the bulkhead end.

The wicket gates are supported from the casing by steel pins or journals and are operated by a steel ring which turns concentric with the main shaft and is moved through mechanism by the governor shaft. The water pressure against the gates is partly counterbalanced to relieve the work to be done by the governor, but the tendency of the gates is to close at all points, so that if anything should happen to the governors by which the pressure should be relieved, the gates would close themselves. All the journals of the shaft transmitting the power are adjustable, both vertically and horizontally. The turbines have an efficiency of 77 per cent at full water; of 82 per cent at seven-eighths water; 82 per cent at three-fourths water and 80 per cent at five-eighths water, so that when operating at the average load, the turbines will be worked at their maximum efficiency.

The governors are of Lombard make. Under operating conditions, they will control the speed within 1½ per cent; they are provided with an electrical adjusting device so that the operator at the switchboard can adjust the speed of the machines from the switchboard when synchronizing.

The generators are of the revolving, field-engine type, 3750 kilovolt-amp, 2200 volts, three-phase, 60 cycles. When operating at their full load for 24 hours with 85 per cent power factor, the rise in temperature would be 50 deg. C. The exciter is an engine type, six-pole, 110-kw, 250-volt, shunt-wound machine; the armature is placed on the main generator shaft just outside of the outside bearing and each machine is large enough to excite two generators under all conditions.

The rotating element of the generators weighs 44,800 lb., turns 240 r.p.m. and the radius of gyration is approximately 3 ft. 6 in., making the fly-wheel effect approximately 574,400 lb. at 1 ft. radius. The leads from the generators pass under the dynamo-room floor up the downstream wall of the building into the switchroom on the floor above where they connect with the low-tension busbars through a selector switch and an electrically-operated oil switch. The floor of the switch room being about on the same level as the top of the transformers, the leads to the transformers pass from the generator leads through an electrically-operated oil switch, protected by selector switches under the floor directly to the transformers, the circuit then passes from the transformers through the large openings through selector switches and high-tension oil switches to the high-tension busbar, thence out of the top of the switchboard room; low equivalent lightning arresters being connected at the outgoing point. No high-tension wire is nearer than 2 ft. to any other high-tension wire and in most places not nearer than 3 ft.

The switchboard gallery, or what might be called the master board, is placed in the center of the generator room on the center upstream buttress wall, about 12 ft. above the generator-room floor. From this point the operator can see all of the machinery in the generator room. The switchboard is of blue Vermont marble; the two main panels each control one generator, one bank of transformers and one outgoing transmission line. At the east end of the board is mounted a swinging bracket which carries a single-phase synchroscope and a 3000-volt voltmeter. There are also two panels which control the

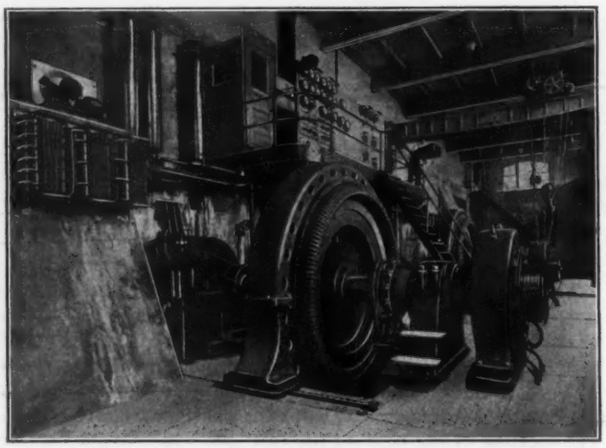


FIG. 3.—GENERATOR ROOM.

exciters and a lamp and motor panel board for the station and grounds.

On the buttress walls next to the one on which the switchboard gallery is supported, to the right and left of the switchboard gallery, the electrically-operated rheostats are mounted. The switch compartment above the generator room and the electrically-operated machinery controlled from the switchboard, contains the necessary switches, etc., for the control of the generator circuits and the outgoing circuits. There are also mounted on this floor six 60,000-volt lightning arresters, oil-immersed choke coils and series coils for the switchboard instruments. The high-tension wiring on this floor is all of No. 2 medium hard-drawn copper, supported on high-tension insulators manufactured by the Locke Insulator Company.

The switching arrangements are designed so that the station is operated on the unit system. Connections, however, are made so that through the busbars any transformer can be connected to any generator and any transformer can be connected to any set of outgoing transmission lines. All the iron work, including the iron cases of all the apparatus installed in this station, is permanently grounded.

There is a water rheostat of sufficient size to carry the full load of the generators, built on the west pier in the tail race. With this rheostat the operator may, in case the governors fail to work and the machines run away, throw a full load on them to hold down the speed. This feature has been provided as a precaution, although the generators are built to withstand the runaway speed of the wheel under any load which is about 50 per cent above normal.

The transformers are three-phase, oil-insulated, water-cooled, and have the same rating as the generators at the same rise in temperature. They are connected delta-to-star, the outgoing transmission system being star connected with a grounded neutral. They are built in iron cases holding the oil and have the following characteristics:

Load.	Per cent efficiency.
¼	95.1
½	97.1
¾	97.55
Full	97.65
1¼	97.6

With a constant voltage impressed on the primary and with full load thrown off, the regulation for unity power factor is 1½ per cent and for 80 per cent power factor, 3.7 per cent.

Before leaving the factory the insulation between the high- and low-tension windings and iron was subjected to a test of 120,000 volts for one minute, and the insulation between the low-tension winding and the iron to a test of 10,000 volts for one minute. The approximate weight of the transformer when in operating condition is 42,000 lb. All of the electrical apparatus in the station was manufactured by the Westinghouse Electric & Manufacturing Company.

There is a small storage battery, consisting of 125 cells, charged by a 2-kw motor-generator set, which operates the solenoids of the electrically-operated circuit-breakers and switches. These instruments operate with approximately 200 volts and as the exciter voltage is controlled by Tirrill regulators and the speed of the generators, it was considered advisable to install a storage battery independent of the generators to operate the switches. The storage batteries are located in a concrete vault-room under the driveway approach to the gantry floor. The storage battery was furnished by the General Storage Battery Company, New York.

POWER HOUSE.

The power house is located between the dam and the west bank of the river in the deepest part of the river and occupies a space approximately 116 ft. 6 in. over all up- and downstream by 139 ft. 8 in. across the stream, or east and west, and from the lowest point of the foundation to the roof is approximately 120 ft. The building is entirely fireproof, with the exception of the doors and windows, which are of wood. The structure is built of concrete and cyclopean masonry, with the exception of the downstream side above the foundations and the east and west walls above the buttress walls, which are brick. In all of the upstream walls and wherever strains other than purely compression strains are to be resisted, the concrete is reinforced with twisted steel bars and thus far no cracks of any kind have developed in any of the walls. Wherever weight only was needed or wherever it was necessary to fill a space or provide for foundation walls, cyclopean masonry was used. The granite rock for such masonry was taken from the excavation work or from a quarry adjacent to the plant. Before beginning the foundation of the building all questionable rock in the river bed was removed. In places it was found necessary to go to a depth of from 12 ft. to 14 ft. lower than was originally planned.

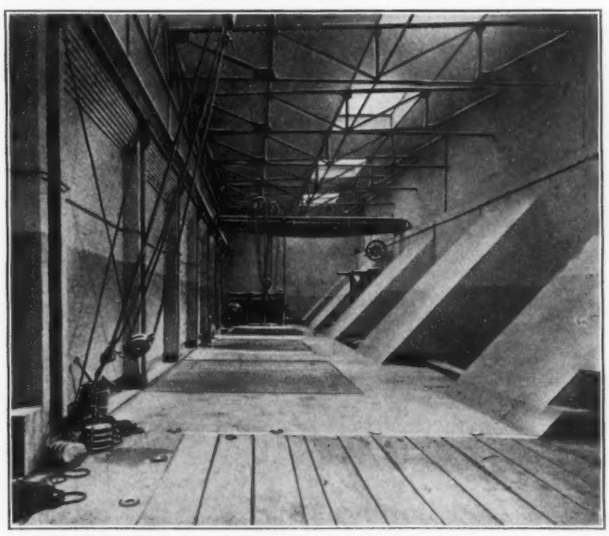


FIG. 4.—GANTRY ROOM.

The water pressure against the upstream face of the power house is resisted by five buttress walls that extend from the water-stop wall at the upstream side of the building and from the top of the building down to the lowest downstream point, these buttress walls forming the dividing walls for the tail water. The buttresses are 12 ft. thick and the spaces between them are 15 ft. wide or the buttress walls are 27 ft. center to center. Between the buttress walls are the turbine chambers at elevation 13, the transformer rooms at elevation 34.6, and between these walls, extending from the turbine chamber floor to the tail race, are the two sets of draft tubes, built in a solid mass of concrete. The upper discharge point of the draft tube is 7 ft. below low water in the tail race, so that the draft tubes are always water-trapped.

At the upstream side of the building, extending the full length of the building and 34 ft. high, averaging about 16 ft. in thickness, is a solid concrete wall, supported by the buttress walls. This wall not only acts as a water-stop, but adds about 4000 tons to the building at a point where it is most effective for stability.

A set of heavy iron trash racks are placed ahead of the gates, through which all the water must pass before it reaches the head gates; these racks extend the entire length of the building. The gates are of wood and handled with a single stem to each gate. There are four gates to each unit covering openings 4 ft. wide by 20 ft. high in the clear, so that when passing 1000 cu. ft. of water per second, or when each unit is developing 5000 hp, the water velocity through the gate openings is only about 3 ft. per second. The water velocity of discharge of the tail water is figured at the same rate, viz., 3 ft. per second.

The turbines are placed in a turbine chamber, the floor of which is at an elevation of 13 ft. The center line of the turbines is 5 ft. higher, making the maximum draft 18 ft. The turbine chambers are accessible from the gantry floor through a large iron door, closed when the chambers are full, over which a traveling crane large enough to handle any part of the turbines passes. There is also provided a manhole through this door and a manhole in the bulkhead plate into the dynamo room. Through these openings a man can pass for inspection or to do any light repair work.

The transformer rooms occupy the space between the buttress walls and extend from an elevation of 34 ft. to the gantry floor at an elevation of 56 ft. A 10-ton traveling crane passes over the turbine and the transformer rooms. The gantry room or floor extends the full length of the power house and is 32½ ft. wide. A traveling crane covering the full width of this floor has sufficient capacity to handle any piece of machinery in the building; this crane not only covers the turbine chambers and transformers, but also the opening or well into the generator room, so that by means of it any piece of machinery can be lowered into or taken out of the generator room. At the west end of the gantry room are large doors to the driveway, which is used for bringing material to the building.

The building is divided lengthwise by a solid brick wall between the gantry room and the switch room; the gantry room is on the upstream side of this wall and the switch room on the downstream side; this wall also forms the downstream wall of the transformer rooms and an opening through this wall between the transformer room and the switch room allows the high-tension wires to pass from the transformers to the high-tension switches.

The switch room is directly over the generator room and extends the entire length of the building. It is 29 ft. 8 in. wide in the clear and 37 ft. high to the roof of the building. All of the switching apparatus is placed in the switch room, including lightning arresters, choke coils, series coils, high- and low-tension oil switches, selector switches, etc. All these switches, with the exception of the selector switches, are operated from the master board in the generator room below.

The generator room extends the entire length of the building and is covered by a traveling crane large enough to handle the heaviest piece of the generators. The floor level is 14 ft. higher than the tail water and 4 ft. higher than the highest estimated water in the tail race during flood periods. The river is very deep for a considerable distance downstream. There is no danger, therefore, from backwater due to log jams, but to provide against this emergency a concrete wall 11 ft. above the dynamo-room floor extends around this room, and pumps are

provided to pump from wells sunk in the floor in case water should come in on this floor.

Ample drains are placed through the concrete walls so that there will be no accumulation of water anywhere in the building. The roof of the building is steel framed, filled with concrete and made waterproof, with a covering of malthoid roofing and copper flashed. The downstream side and east and west sides of the building above the concrete and also the middle wall of the building above the concrete are steel framed, the steel work being heavy enough to carry the cranes; the filling is of brick. The coping and the eaves of the building are of concrete block. There was no particular attempt at ornamentation. The building, however, is well proportioned and presents a pleasing appearance and is a good example of a structure used for industrial purposes.

Electric Pumping at the Duluth Waterworks.

One of the most interesting electric pumping installations in the United States is that recently put in operation at the Duluth (Minn.) waterworks. The interest lies not only in the high efficiency obtained from the centrifugal pump used, but in the fact that it is probably the forerunner of numerous other electric waterworks pumping installations throughout the country, for which it establishes a precedent.

The Duluth waterworks was confronted with the necessity of enlarging its capacity. It had already installed the two

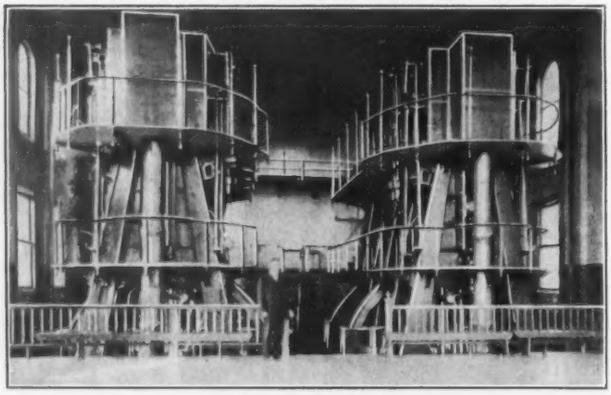


FIG. 1.—STEAM PUMPING UNITS.

steam pumping units shown in Fig. 1, each of which has a capacity of 5,000,000 gal. of water in 24 hours, against a 300-ft. static head. About that time the Great Northern Power Company, of Duluth, was beginning to deliver power from its large water-power plant on the St. Louis River, and the question of electric pumping was taken up. As there were so few precedents for the operation of a waterworks as large as this with electric pumps, the Great Northern Power Company had considerable difficulty in getting the electric pumping proposition seriously considered. When bids were submitted by the makers of steam and electric pumps, however, the great difference in first cost and the limited amount of money available for waterworks improvement, caused the electric pump to be given more serious consideration.

The lowest bid on a 12,000,000-gal. steam pump was $90,000, erected on foundation. This did not include piping or necessary boilers. The electric pump, motor and transformers, delivered and erected, cost about $16,000. The piping and meters cost about $4,000 more and the transformer house $3,000, making an approximate total cost of $23,000 for the electric outfit. The electric pump shown in Figs. 2 and 3 consists of a 1000-hp General Electric induction motor running 750 r.p.m. direct-connected to a two-stage centrifugal pump made by the I. P. Morris Company. This pump has a 20-in. discharge. Its capacity is about 13,000,000 gal. in 24 hours, against 300-ft. static head. It pumps to a reservoir through 30,000 ft. of 42-in. steel main. The output of the pump is measured by a Venturi water meter. The motor, pump and piping are all installed in the basement of the waterworks. Its small size is in strange contrast to the two mammoth steam engine pumping units in Fig. 1, which aggregate a less capacity. It is only 17 ft. x 6 ft. 8 in. over all. The base is 12 ft. x 6 ft. 8 in. An amusing story

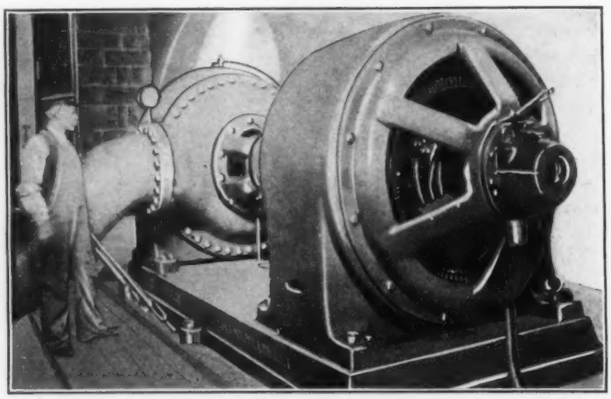


FIG. 2.—1000-HP ELECTRIC PUMP.

is told of an officer of the power company who went to the waterworks to see the new pump, but went away without finding it, as it was tucked away in one corner of the basement.

The Great Northern Power Company pumps this water at the rate of $6.50 per 1,000,000 gal., as measured by the Venturi meter. As the contract is on a basis of water pumped rather than kilowatt-hours, the power company was naturally much interested in the efficiency obtained. After considerable study and some experiment, a remarkably high efficiency has been obtained on this pumping unit. In fact, it marks an important advance in the manufacture of centrifugal pumps. The efficiency over all of the pump, motor and step-down transformers as determined by tests conducted by H. M. Byllesby Company, who were called in as independent engineers, was 73.1 per cent. This is believed to be the best efficiency ever obtained from a centrifugal pump, and in fact, the successful bidders were the only ones who would guarantee 70 per cent efficiency, which efficiency was not obtained without considerable study.

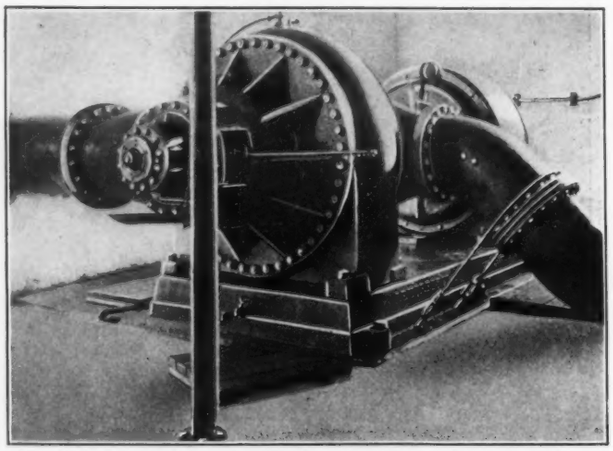


FIG. 3.—13,000,000-GAL. ELECTRIC PUMP.

It is estimated that the rate of $6.50 per 1,000,000 gal. nets the company about 5 cents per kw-hour. The contract permits pumping only 18 hours per day, the hours of pumping to be specified from time to time by the power company. These hours may be changed upon a few days' notice. This keeps the pumping load off the company's peak.

A separate line for this purpose is built from the company's

substation in Duluth to the waterworks, about 4 miles east of the city limits. This transmission line is built so that duplicate lines can be placed on the poles. At present only one line is used with the wires arranged as indicated in Fig. 4. Fig. 5 shows the waterworks plant exterior with the brick substation or transformer house which was erected apart from the main building. This transformer house contains three 333-kw step-

FIG. 4.—VIEW OF TRANSMISSION LINE.

down transformers. Current is received at 13,000 volts. It is controlled by a standard switchboard panel containing an indicating ammeter, indicating wattmeter, watt-hour meter, time limit relay and oil switch handle. The transformers are water-cooled. The switchboard panel is the standard used by the Great Northern Power Company on all of its wholesale power customers. The first month the pump was in operation, July,

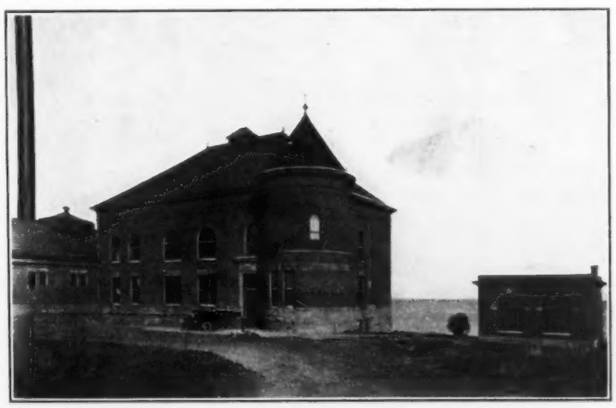


FIG. 5.—STEAM PUMPING PLANT AND TRANSFORMER HOUSE.

1908, 177,000,000 gal. were pumped, so that the present requirements are less than 6,000,000 gal. per day. The cost of steam operation was $8.50 per 1,000,000 gal. When the steam plant was operated regularly, nine men were employed at the pumping station. This force has been reduced to six men. The steam units in the station are, of course, kept in shape and operated occasionally to provide against break-down of the power service.

The Recent Change in British Patent Law.

BY AN ENGLISH BARRISTER.

All the English newspapers of light and leading report the 28th day of August, 1908, as the commencement of a new era in English patent law. That an important modification of the law commenced on that day there can be no question; whether the change will be so momentous as was at first supposed time alone will show. Inasmuch as this alteration of the law is of as much importance to persons foreign to England as it is to Englishmen themselves, it is proposed to consider, in the first place, the nature of the proposed change, and in the second place to collect together some evidence as to the effect which the change has had. A few observations on the question whether and how the act may be evaded may also be found useful. The various methods of working a patent in England have already been considered in these columns.*

NATURE OF THE CHANGE.

By the Patents and Designs Act, 1907, the government of Great Britain recognized for the first time the necessity of compelling the owner of a patent to actually make and work his invention in the British Islands. It had been pointed out that many inventors in Germany and elsewhere took out English patents, only to sit on them. One authority estimated that England had lost £600,000,000 in this way. In certain great industries, the law which permitted such a state of affairs was thought to operate harshly upon manufacturers and the public generally. In the result, the act of 1907 was passed to remedy this state of things. Its material provisions are shortly as follows:

1. At any time not less than four years after the date of a patent, and not less than one year after the passing of this Act (Aug. 28), any person may apply to the Comptroller of Patents for the revocation of the patent, on the ground that the patented article or process is manufactured or carried on, exclusively or mainly, outside the United Kingdom.

2. The Comptroller shall consider the application, and, if after inquiry he is satisfied that the allegations contained therein are correct, and unless the patentee proves that the patented article or process is manufactured or carried on to an adequate extent in the United Kingdom, or gives satisfactory reasons why the article or process is not so manufactured or carried on, the Comptroller may make an order revoking the patent, either (*a*) forthwith; or (*b*) after such reasonable interval as may be specified in the order, unless in the meantime it is shown to his satisfaction that the patented article or process is manufactured or carried on within the United Kingdom to an adequate extent: Provided that no such order shall be made which is at variance with any treaty, convention, arrangement, or engagement with any foreign country or British possession.

3. If within the time limited in the order the patented article or process is not manufactured or carried on within the United Kingdom to an adequate extent, but the patentee gives satisfactory reasons why it is not so manufactured or carried on, the Comptroller may extend the period mentioned in the previous order for such period not exceeding 12 months as may be specified in the subsequent order. The decision of the Comptroller is not final, but may be appealed from either by the patentee or the other party to the litigation.

It is necessary to make it plain that this change in the law is not solely aimed at patentees who are foreign to England; it applies equally to Englishmen who for some reason think it wise to work their patents outside of Great Britain. Special mention is made of this point because in a recent article in an American journal, a member of the New York Patent Bar asserts that the new law does not deal equitably with all patentees, but enforces the compulsory working clause only against patentees foreign to England. This is incorrect.

It is difficult to see any way of escape for a patentee from the provisions of this stringent enactment. The foreign manufacturer wishing to keep his trade in England in the patented article must needs have it manufactured in England. Already fully 30 foreign firms have made or are making arrangements for opening factories in the British Isles, for producing such goods as aniline dyes, pottery, plant for gas making, rifles, patent foods, electrical contrivancies, mercerized cotton, furnaces, sanitary appliances, typewriters, safety razors, phonograph records, shoes, telephone implements, and wire cloths. A well-known public man in England—Sir Alfred Jones—has prophesied that the immediate result of the Act will be the investment of £25,000,000 for the manufacture in England of articles previously made abroad.

With regard to the number of persons likely to be affected it is not very easy to be precise. It is estimated that some

*See an article "How to Work a Patent in England," ELECTRICAL WORLD, Aug. 15, 1908.

70,000 persons foreign to England who are holders of patents in England have been notified of the changes recently made. Of these, not all are directly concerned. Some are engaged in trades which have no competition in England, and are little likely to arouse opposition. Many, again, send goods to England in such small quantities that interference is not probable. In 1906 British patents were issued to:

British subjects (including persons resident in the British Colonies)	8,204
Americans	2,595
Germans	2,091
Persons from other countries	1,817
	14,707

When a comparison is made between the number of patents issued to "foreigners" in the United Kingdom, and the number issued in other countries to persons foreign to those countries, the figures are not a little startling. Thus the percentage of patents issued to foreigners in Great Britain, the United States and Germany was as follows:

Great Britain	44.2
United States	10.9
Germany	34.9

British subjects (including British Colonials) received from America 1622 patents, and from Germany 883. It will thus be seen that the British Government has been in the habit of issuing more patents to American and German inventors than the authorities of either of these countries are of issuing to people domiciled in England. Taking the figures for 1907, it is to be observed that in 1907, out of a total of 16,272 persons holding patents issued in the United Kingdom, 2792 were resident in the United States of America, and 2608 in Germany.

In a letter addressed to one of the leading English technical journals on Aug. 15, Messrs. Leopold Farmer & Sons, a firm of surveyors who are specialists in dealing with factory property in England, say that there is every possibility of the opening up of numbers of unlet works in the United Kingdom in the near future. They also write: "The foreigner (using that term to mean persons foreign to England) affected by the Act passed in 1906 has to look to the future to protect his manufacture, with the result that each of the following important firms has acquired land and factories in England to carry on their business:

"1. Elberfelder Farbenfabriken (represented by the Bayer Company, Ltd.) acquired 24 acres of land at Port Sunlight, Cheshire. 2. Hoschlisfarbwerke Company, acquired 7 acres of land at Ellesmere Port, Cheshire. 3. Gillette Razor Company, works, Leicester. 4. Sanatogen Food Company, land, Cornwall. 5. Pintsch Suction Gas Plant Company, works, London. 6. National Cash Register Company, works, London.

"In addition to the foregoing specific instance of actual movements, we are in negotiation with numerous German and American manufacturers requiring sites and factories in different parts of England—the trades to be carried on consisting principally of chemical, engineering or pottery industries.

"We feel certain, having gaged the feeling abroad on the effect the passing of the Patents and Designs Act is having on manufacturers, that the movement is only beginning, and there will be a big development of it, principally among German manufacturers who are makers of numerous chemical products largely used in dyeing, etc. The American industries, being more in machinery, is not so much affected, but from the match, electrical, pottery and other industries, we may have firms opening up works in England."

To the list of industries specified in the foregoing letter there may be added the following firms: The Deutsche Waffen & Munitions Fabriken, of Berlin, which is looking for a site on which to erect workshops for the manufacture of the famous Mauser rifles. Another German firm is seeking 50 acres of land in the neighborhood of Flint, North Wales, on which to build extensive works for the production of mercerized cotton. Eventually 1000 "hands" will be employed. Germans have opened new works at Brimsdown, Enfield, and a number of local women have just returned from a visit to the firm's headquarters after being initiated in the duties they will have to perform. The Clinton Wire Cloth Company, of Massachusetts, U. S. A., are on the point of acquiring a large property in Cheshire. In northeast London the Buffalo (U.S.A.) Specialty Company have acquired a factory, while an American engineering firm is on the lookout for a site in the London district.

CAN THE NEW ACT BE EVADED?

This question is likely to agitate the minds of American inventors who have no desire to embark upon the costly expedient of erecting a factory in England. We have seen that a patented article must be "manufactured," or a patent process must be "carried on" within the United Kingdom. But what constitutes the manufacture of a patented article? Some patents consist of one single undivided article; but others are composed of a number of distinct parts. The patented article does not really come into being until these parts are united.

Upon the question whether the mere putting together in England of the parts of a machine, say, a typewriter, which have previously been made in America or Germany, will be a sufficient compliance with the Act, this may have to be determined at some time by litigation. At least one large American firm is taking no risks. It is opening up manufacturing works in England; but there may be many others who will not be afraid to run the risk.

Another question also forces itself into notice. A patent often amounts to a combination of one or more old devices. In such cases the question must necessarily arise sooner or later—Will the mere putting together of two old devices amount to sufficient manufacture within the meaning of the Act? If it does, then the cost of erecting an expensive factory in England may be saved. No doubt, some of these difficult points will form the subject of judicial decision in the English courts.

As to the immediate effect of the Act in England, it is claimed by some politicians that it must give rise to employment for the British workman. One prominent member of the Labor party denies this. In the course of a speech recently made by him, Mr. Will Thorne said:

"I believe that in consequence of the Act a good many foreign manufacturers will be obliged to build factories in this country, but I do not say that the building of factories here is going to give employment to a lot of our own people. On the contrary, I am inclined to the belief that every foreign firm which erects a factory in this country will employ their own people, and not Englishmen. My own idea is that the Act, which one would imagine is a Protectionist one, is not going to solve in any way whatever the question of unemployment in Great Britain. The only thing I can see the Act is likely to do is to intensify the competition in England between foreign and home firms, and create a tendency to keep down prices. An advantage which the Act will achieve will be the revenue derived from the taxation of all factories built in this country by a foreigner by local authorities. Assuming that this Act had not been passed, the self-same firms who are now seeking for sites for factories in England would have been in a position to negotiate their wares in this country in precisely the self-same way in which they have hitherto done. I fail to see that, from a competitive standpoint, the Act will make any material difference to Great Britain. There is nothing Protectionist about the Act."

THE ACT BENEFICIAL TO THE FOREIGN INVENTOR.

Enough has been said, however, to show that, in so far as compulsory working is concerned, the Act of 1907 is likely to have a serious effect upon foreign patentees. But in another respect it is calculated to confer a boon upon the inventor, whatever his nationality. This part of the Act requires a few words of introductory explanation. Every inventor may do one of two things. He may either take out a patent or keep his process or method a secret from the rest of the world. If absolute secrecy were possible, or if the process, or process of manufacture were such that they could not be easily imitated, the position of the inventor would be much better if he did not take out a patent. As the law of England was before the Act of 1907, the owner of a secret process always ran the risk of being betrayed by an employee, or of some person getting hold of the invention by surreptitious means and forestalling

him in an application for a patent. Now, however, by the Act of 1907 the risk of invalidation owing to publication arising from disclosure through a breach of confidence, is entirely eliminated. In future, an inventor who, after working a process in secret for many years, finds one day that his secret has been stolen, may still apply for a patent. His application will be granted as the publication which has occurred not being such as to impugn the validity of the patent so granted. Moreover, having obtained his patent, he can, it would seem, successfully maintain his exclusive right to the use of the invention, even against the person who was employing the patented process at the date of the patent. The principal risk to which secret working was hitherto exposed being thus removed, the inducement to adopt this course of working an invention is immensely increased. This amendment of the English law is one which may be of considerable importance to the American patentee who is contemplating the manufacture of an invented article in England.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Vacuum Cleaning Load.

Motor-driven vacuum cleaning is an application calling for central-station service which is worth watching and cultivating by all electric light companies having a day service and which wish to popularize the service in the residence districts and secure additional day load. A short time ago the only vacuum-cleaning outfits on the market were those of the large expensive type suitable only for hotels and large office buildings. Now there are a number of small stationary machines on the market which are within the financial reach of a large number of owners of smaller buildings. Portable outfits are also obtainable which can be taken from house to house and thus vacuum cleaning can be enjoyed even by those whose needs do not justify the purchase of an outfit of their own. These portable electrically-operated outfits can be used wherever there is electric service and are not only less expensive but less offensive than the gasoline engine outfits which are familiar sights on the streets of the larger cities. The advent of the portable electric outfit which can be handled by one man has brought both the first cost and the cost of operation down to a point where it is within reach of every residence owner who can afford to hire a man by the day occasionally to do cleaning. Probably the best plan where no one else will take up the matter in a town is for the central station to buy one or more outfits and rent them out by the day either direct to householders or to the men who make a regular business of cleaning in the town and who have an established list of customers. Of course the places not wired for electric conveniences cannot use the vacuum cleaning machine, and this in itself will be one of the strongest incentives for the housewife to put in electric lights so that she can get vacuum cleaning service. If the outfit is one requiring a 2-hp or 3-hp motor, as do the larger "one man" portable machines, the connection can be made, by means of a long flexible cable, to a point near the entrance of the main service wires to the consumer's branch cut-out cabinet after they leave the meter. This will usually give sufficient capacity to operate the motor safely and the main service fuse will protect the motor. Some of the smaller machines which are taken from room to room can be connected to lamp sockets wherever desired.

As to the relative merits of the large and small machines there is considerable controversy. While it is undoubtedly true that a motor of only 1-6 hp which can be connected to a lamp socket does not create a very strong vacuum, it is also probably true that frequent cleaning with a light vacuum is for practical purposes more satisfactory than very infrequent cleanings with a powerful vacuum. The prices of current for house to house cleaning with the enormous gasoline engine vans requiring a team of horses and a crew of men to operate are necessarily so high that few householders feel that they can afford the luxury of vacuum cleaning at frequent intervals. Consequently a powerful vacuum is needed for such work. Remove the financial burden which the heavy machinery imposes and undoubtedly some of the necessity for powerful vacuum goes with it. The vacuum cleaning art is yet rather new, and it yet remains for the test of extensive practical experience to determine just how far it pays to reduce the weight and size of a cleaning machine in order to make more frequent cleaning possible. But it is certain that vacuum cleaning has come to stay and that when used with the electric motor drive it is to prove one of the greatest of modern electrical conveniences. Progressive electric light companies are taking hold of it in the manner indicated and are also urging the installation of permanent stationary plants in large buildings. Owing to the boom the business is experiencing and the fact that so many small outfits are being offered on the market it will be well for companies to investigate their merits thoroughly before buying as it always occurs when a boom of this kind is on that some experimental and untried apparatus is put out.

Application of Alternating Current for Electrical Hoists in New York City.

BY T. I. JONES.

In the ELECTRICAL WORLD of April 4, 1908, there appeared an article illustrating the advance made in the use of alternating current for commercial purposes throughout Manhattan Island during the past year. To show the use to which alternating current is being put at the present time in the construction of some of the larger buildings in the same territory, the Fifth Avenue Building, on the site of the old Fifth Avenue Hotel, at the junction of Broadway, Fifth Avenue, Twenty-third and Twenty-fourth Streets, may be cited.

The Fifth Avenue Hotel was one of the first hotels in New York to use electricity for lighting and for operating motors. Over 19 years ago an electric installation of approximately 3000 16-cp incandescent lamps was placed in the hotel and later alternating-current motors were installed for driving the ventilating and refrigerating apparatus. On the site of the old hotel building the Hedden Construction Company is now engaged in erecting a 14-story structure. This building will be used exclusively for offices and store purposes, and will be ready for occupancy about May 1, 1909. In the construction of this 14-story building over 600 hp in alternating-current hoists and a large installation of incandescent and arc lamps, fed from alternating-current mains, will be used.

For a number of years the Hedden Construction Company has used steam hoists in its building operations. With a view, however, to reducing the expense incident to the use of steam, and in an endeavor to find a hoist capable of being used throughout the country on the service of the various electric lighting companies, the Hedden company made a careful test of all types of hoists now on the market. Not only was the general applicability of the hoist to the mains of the various electric-lighting companies considered, including the cost of transportation to the places where the hoists would be used, but the maintenance of the apparatus and its depreciation as used out of doors, were also carefully studied. As a result of this investigation, hoists operated by alternating-current motors were decided upon and an order for a number of them was placed with one of the largest hoisting-engine companies in New York City. A photograph of one of these hoists in actual operation is shown in Fig. 2.

The hoist shown is of the friction-drum type, and is equipped with a General Electric alternating-current, two-phase, variable-speed motor. The hoist used on the Fifth Avenue Building is rated at 52 hp, and speed changes are obtained by means of an adjustable resistance placed in the rotor circuit. On account of the large resistance required when operating at low speeds, grid rheostats are placed external to the motor. Collector rings keyed to the shaft connect the rotor to the drum and rheostat through brush gears provided for this purpose. The cast-iron grids are mounted in an open iron frame permitting free circulation of air. The top is of iron with a slate centerpiece through which the cables are carried to the controller. The complete hoist is guaranteed to lift a load of 1000 lb. to 1500 lb. at a speed of from 1000 ft. to 1200 ft. per minute. The entire machine, motor included, being guaranteed at a stated efficiency for a period of one year. The hoist shown in Fig. 2 is operated from 220-volt service, the motor being thrown directly upon the alternating-current mains through the rheostat, the load starting with the motor and not being thrown on the motor

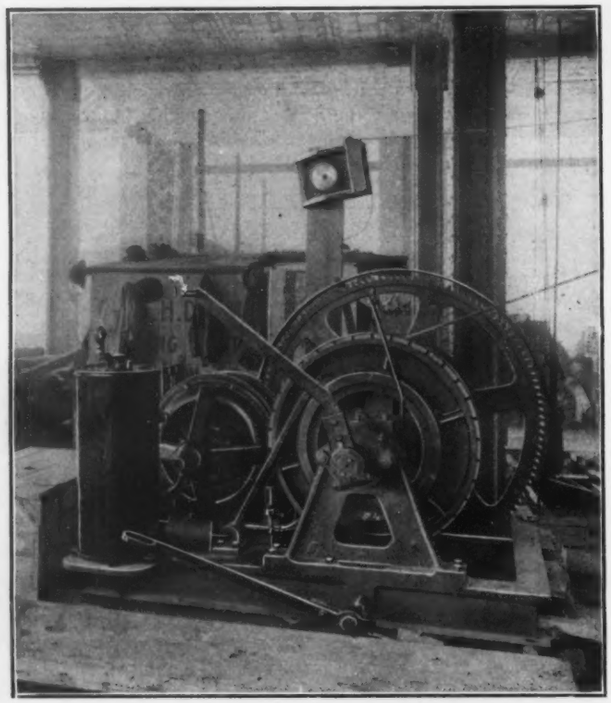


FIG. 1.—ALTERNATING-CURRENT HOIST.

after the latter is up to speed, as has heretofore been done in most electric hoisting operations.

From the standpoint of expense of operation to the contractor, the electric hoist is cheaper than the steam hoist, owing to the fact that energy is consumed only during the actual operation of hoisting, while the steam hoist has to be in readiness the entire working day, thus consuming coal for a period of approximately eight hours—the usual working day—while the actual operation of the engine would probably approximate but little over four hours continuous service. Some idea of the care incident to the use of a steam hoist may be obtained by reference to Fig. 3, taken from a picture of a steam hoist used on the Fifth Avenue Building prior to its replacement by an electrical machine. A careful scrutiny of this picture will show, first, the extreme height necessary for the boiler of the engine; second, the water barrel just back of the boiler; third, the space used for the coal pile, and, fourth, the rake and necessary space required for the removal of ashes and maintenance of the fire. The illustration cannot give an idea of the noise, smoke or vapor arising from the use of the steam hoist, nor does it give an idea of the excessive vibration caused by the speed at which the steam engines operating the drum must run.

The cost of maintaining a steam hoist is high. It has many parts and depreciates rapidly when exposed—as hoists must be—to weather conditions. An electric hoist equipped with an alternating-current motor, from its system of construction, is maintained at a lower cost. Because of its small number of parts and the fact that the motor is almost entirely enclosed in its end shields and field castings, it is not affected by the various changes of weather. The depreciation of an electric

FIG. 2.—ALTERNATING-CURRENT HOIST.

hoist for these reasons is small. A comparison of the steam with the electric hoist, including maintenance of parts and cost of operation, together with loss due to depreciation, shows a material saving in favor of the electrically-operated machine.

Following the use of these alternating-current hoists on the Fifth Avenue Building, the Hedden Construction Company will transport some of them to Newark for use on the new

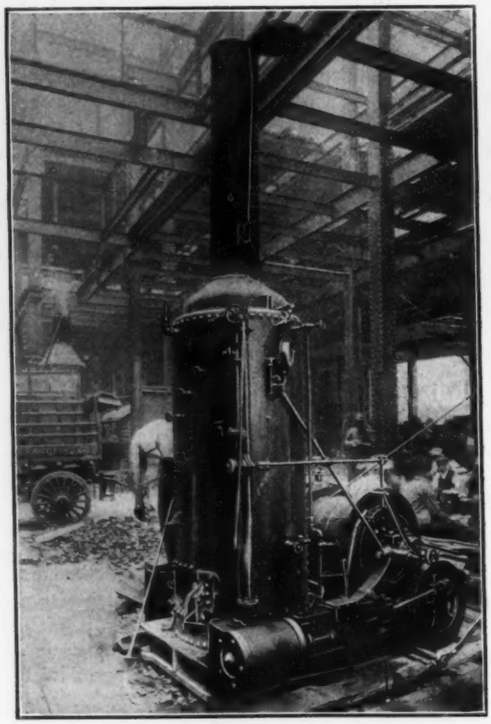


FIG. 3.—A SUPPLANTED STEAM HOIST.

structure of the Prudential Insurance Company. While in New York, the electric service to the hoists and for the lighting of the Fifth Avenue Building during its construction will be from the alternating-current mains of the United Electric Light & Power Company, and while in Newark the energy will be supplied from the mains of the Public Service Corporation.

INTERIOR WIRING AND ILLUMINATION

The Wiring and Illumination of the Hudson Tunnels.

By N. A. Cornell.

THE lighting requirements of underground tunnels and stations demand that the illumination shall not only be ample, but also constant under any condition that may arise in the operation of the system. In the lighting of the tunnels and underground passenger stations of the Hudson & Manhattan Railway Company (familiarly known as the McAdoo Tunnels), an interesting solution of this problem is presented—not because of its complex features, but because of the simplicity and completeness of control.

The source of supply consists of two 3000-kw, 11,000-volt, 25-cycle steam-turbine units located in the main power house at Jersey City, either or both of which may be connected to the lighting busbars. From the power-house switchboard the energy is conveyed through three-conductor, paper-insulated cables drawn through the tile ducts to the transformer closets at the passenger platforms.

Oil-filled, single-phase transformers located in these station

FIG. 1.—PENDANT BALLS IN A STATION.

closets supply 600-volt current for the lighting of platforms and adjacent portions of the tunnels. These transformers have the middle point of the secondary winding substantially grounded. Transformers rated at 25 kw have been selected as units, there being one or more of these units at each station depending on the load attached. Connections to the primary side of the transformers are made through disconnecting switches and 11,000-volt, 4-amp tube-fuses mounted on high-tension insulators and soapstone panels and barriers. The fronts of these panels are fitted with removable asbestos-board doors to prevent accidental contact by workmen. Each panel contains three of these switches and fuses, and all three phases are brought to the jaw sides of the disconnecting switches. This arrangement makes it easy to balance the various transformers on the phases and also allows a shifting of the load from phase to phase should the need arise. Where the transformer closets are small, these primary panels are located opposite to the doorways so that the switches may be operated by long handles from without the compartment. A view of this primary panel outfit in place in transformer closet is shown in Fig. 2.

From the secondary side of these transformers, feeders are carried in conduits under the overhang of the platforms and in the floor to the distributing centers, and where more than one unit is needed to supply the load at any station, separate feeders from each transformer are carried to the distributing center or centers. These distributing centers are placed where they will be easy of access by the station attendants; the points selected being as nearly central as possible with relation to the loads supplied. The switch and fuse-control panels located at these centers are designed with a separate section for each transformer supplying such panel. Each transformer section of panel is fed through a double-pole, double-throw, quick-break knife switch on the panel so arranged and connected that in case of trouble on any transformer or feeder supplied by it the throwing of this switch will connect the entire section affected to the contact rail. In addition to the one or more transformer sections each control panel has a section connected

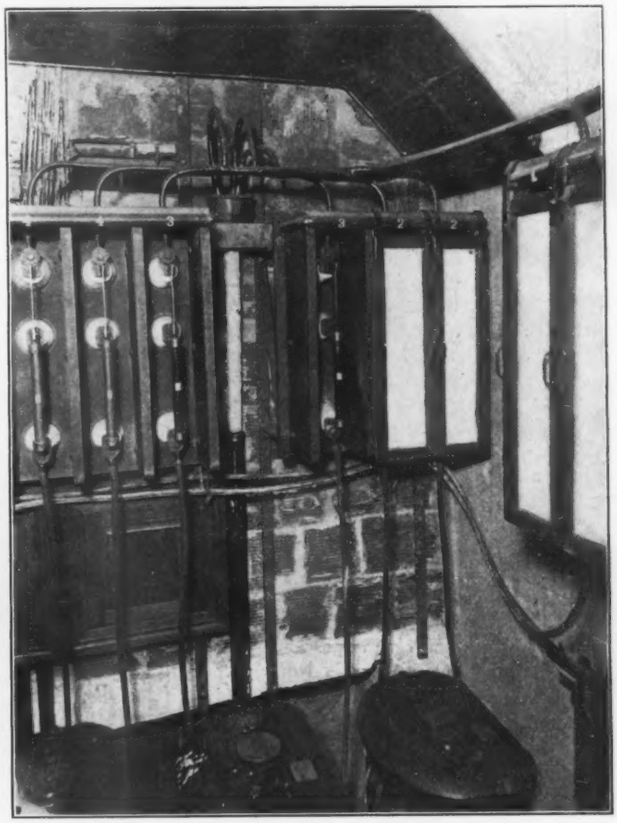


FIG. 2.—PRIMARY PANEL OUTFIT.

directly to the contact rail. A view of one of these control panels is shown in Fig. 3.

The lamps on platforms, ticket offices, passages and stairways are divided between the one or more transformer sections and the contact-rail section of the distributing panels in such a way that no area will be at any time without enough illumination to enable the public easily to make their way to and from the stations; and should there be diminution of light caused by trouble on a transformer or feeder, it would be only for the short time necessary for an attendant to throw the switch on the distributing panel.

Branch conduits are substantially grounded and are installed concealed in the floors, walls and ceiling of platforms. Most of these ceiling tubes and outlet boxes were put in over the wood forms and the concrete arches cast around them, thus obviating any weakening of the arch due to cutting after the concrete had set. In the tunnels conduits are run exposed. Galvanized straps and expansion bolts are used for securing the conduits in the concrete sections of the tunnels. In the cast-iron ring section of the tunnels, the conduits are held in place by gal-

vanized strips of various lengths (and with punched ends), one end being secured back of a lock-nut on one of the bolts holding the cast segments of the tube together, the other end being slipped over the conduit. The conduits are placed high up on the tunnel sides at such points as to be out of the way of

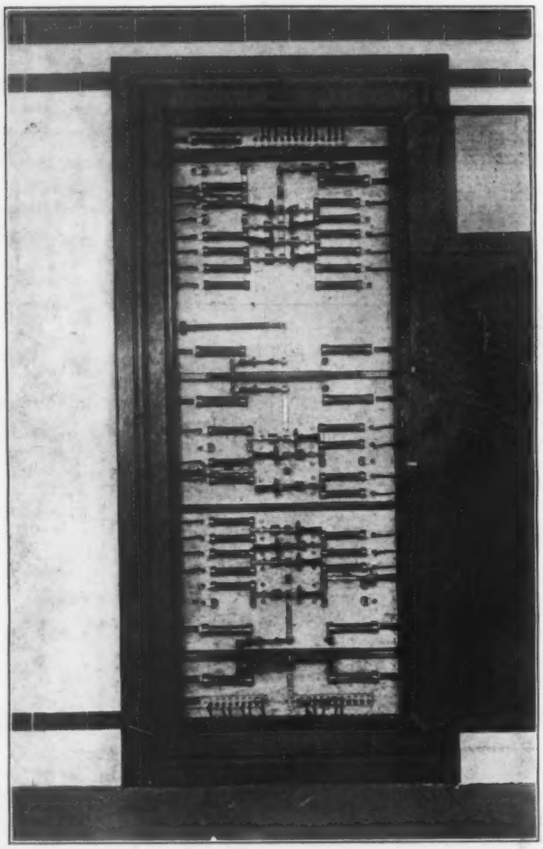


FIG. 3.—CONTROL PANEL.

trains, and so that the lights in the tunnel will not shine in car windows to the annoyance of passengers. Between any two series of five lamps the conduits bend down to easily accessible junction boxes, in which are placed section fuses for the connections and control of each five lamps. This bend in the conduit also takes care of any expansion in the conduit lengths. These junction boxes provide convenient points for testing the tunnel wires and also permit temporary portable lighting connections during road-bed repairs.

Insulated wire for the system has been furnished to meet rigid specifications as to stretching, recovery and chemical tests as well as the usual voltage tests. Conductors have from 1/16-in. to ⅛-in. rubber walls depending upon the size of conductor, and wires are covered with substantial double braid. Lead sheathing has been omitted from all secondary wires that go in metal conduits in order to avoid any pitting of the lead that might arise either from chemical action or possible stray currents.

Platform fixtures are made of cast iron heavily plated with bronzed copper and contain clusters of five series lamps, which unit has been selected for ceiling outlets so that when one lamp of the series burns out the position of this lamp is determined and its replacement made from one point, thus saving in maintenance cost. For high ceilings, pendant balls are used for fixtures (as shown in Fig. 1) and for low ceilings the lower half of the same style pendant ball is used; all parts being interchangeable and requiring but few fittings kept in stock. The usual fixture insulating joint is omitted; the metal portion of the fixtures being connected to the grounded conduits and the branch circuit wires carried directly to the cluster or socket. This forms a very rigid and substantial fixture suspension and prevents the possibility of a maintenance attendant making a ground connection through his body, between the metal part of a defective fixture and the adjacent structure.

The lamps used in the tunnels and in front of platforms are placed in single sockets, five in series. Tunnel lamps are spaced 30 ft. apart on alternate sides of tube and each line in any section of tube between stations may be controlled from the station platform at either end. The normal connection of these tunnel lamps is such that each platform controls one line in each tube, it being a remote possibility that feeders at both ends should give out at the same time. Tunnel lamps are

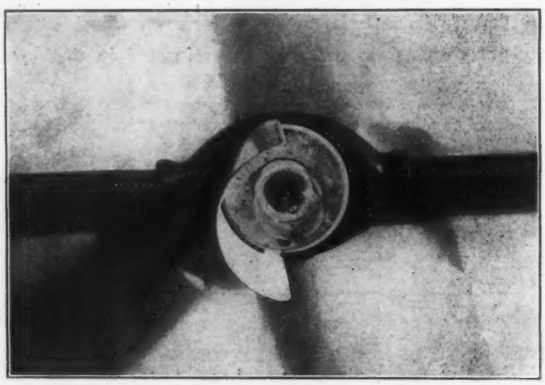


FIG. 4.—OUTLET BOX AND LAMP EQUIPMENT.

fitted with enamel shields placed on the side from which trains approach, and the lamps point down not only for ease of removal, but also that the outlet box may form a moisture shed for the lamp socket. This outlet box and lamp equipment is shown in Fig. 4.

The light intensity in the tunnels is amply sufficient for track inspection and the distribution of light in passenger stations is such that the variation in intensity on platform floor is very small. The globes at all platforms, except terminals, have translucent figures or letters burned in them to enable the passengers easily to read station locations even though the train be moving at considerable speed. Many attractive day and night signs are also placed at the various street entrances to the tunnels to direct traffic.

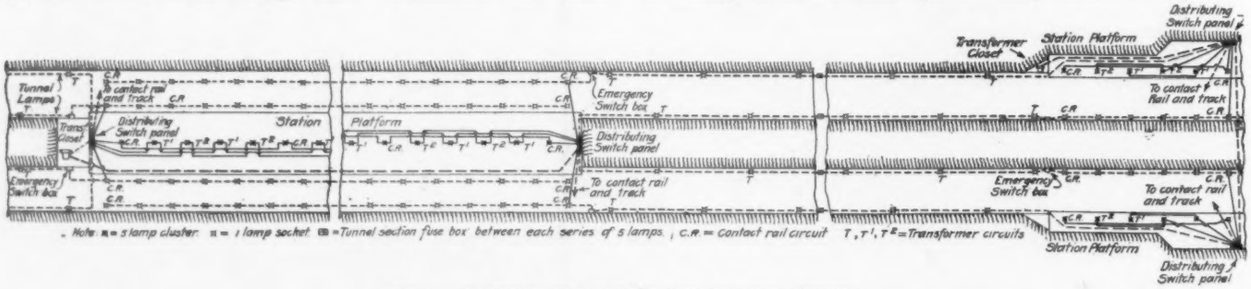

Tunnel Lamps
To contact rail and track
Trans. Closet
Distributing Switch panel
Station
Platform
Emergency Switch box
Transformer Closet
Station Platform
Distributing Switch panel
Note: ▭ = 5 lamp cluster ▭ = 1 lamp socket ▭ = Tunnel section fuse box between each series of 5 lamps. C.R. = Contact rail circuit T, T¹, T² = Transformer circuits

FIG. 5.—DIAGRAM OF STATION AND TUNNEL WIRING.

The entire system has been designed and installed with the purpose of obtaining all the results desired at a low maintenance cost and simplicity and substantiability have been the aim throughout. The diagrammatic scheme for wiring platforms

and tunnels is given in Fig. 5, and a partial view of the terminal at Hoboken is shown in Fig. 1.

The lighting equipment was installed by the Tucker Electrical Construction Company, of New York City, acting under Dr. L. B. Stillwell and Hugh Hazelton, the electrical and consulting engineers.

New Telephone Patents.

TELEPHONE REPEATER.

The telephone repeater is the subject of two patents recently issued to Mr. H. E. Shreeve, of Wyoming, N. J., and assigned to the American Telephone & Telegraph Company. One of these relates to the repeating circuit and the other to the repeater apparatus. The first repeater suggested was of the microphone type, but many years were required to get it in working condition, because of the multitude of refinements necessary to successful transmission. The refinements apply not only to the apparatus, but also to the circuit.

Of the latter, one lies in the necessity for balance, it being required, for non-interference, that as far as the repeater is concerned the line legs on both sides of the repeater have equivalent line characteristics and constants. The circuit patent herein referred to describes a method of connecting a repeater in a circuit so that a sufficient balance may be obtained by the operator by the use of an adjustable resistance. The circuit is shown in Fig. 1, as a part of a cord circuit. It will

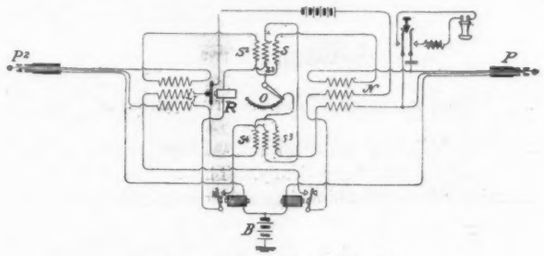


FIG. 1.—SHREEVE REPEATER.

be noticed that both line limbs may be traced through the repeater cord, of course including the various coil windings. It will also be observed that a short circuit, more or less perfect, at will, occurs at the adjustible resistance at *O*. In operation, electricity entering at plug *P* passes through the secondary coils of *N* and through *S* and S_3 and through *O*. The current induced at *S S* in the primary windings affect the repeater *R*, the transmitting side of which sets up a new current in the circuit including the primaries of *N N*, a reinforced current going forth toward both plugs P_2 and *P*. If the line constants be sufficiently alike in both directions then the reinforced or reissued currents will balance at coils *S S*, the two secondaries producing together null effect upon the primary. If, however, the balance is not good enough, a humming is set up. The humming can be reduced by increasing the bridge resistance at *O*, by reducing the power of the repeater and by forcing a part of the original current over into the distant line loop.

NEW APPARATUS.

For some time past desk-stand telephone sets have been manufactured "knock down," so that by the simplest means all working parts might be exposed for inspection and repair. In the type put out by the Dean Company all electrical parts are in the base, the upright stem, carrying the switchhook, enclosing a purely mechanical linkage for engaging the switch springs in the base. As an improvement of this type, Mr. S. A. Beyland, of Elyria, Ohio, has patented an interchangeable apparatus base plate. Plates may be made up as units for several different types of circuits, and the desired variety may be inserted in working position in any desk-stand casing. The patent is assigned to the Dean Electric Company.

An enclosing box for portable sets forms the subject of a patent issued to Mr. O. H. Goodrich, of Castleton Corners, N. Y. This casing is large enough to receive the portable stand in an upright position, and has a switchhook at one side which takes the receiver and which is connected by a linkage to the portable stand hook. An aperture is cut in the front of the casing to fit approximately the contour of the face and thus to shield the mouth of the user so as to prevent conversation being overheard.

Mr. John J. Kelly, of St. Louis, has provided a means of signaling from one station to another, when both stations have been temporarily left with receivers off the hooks. One means consists of a vibrator to be connected across the line by a push button. The current fluctuations at the central office repeating coil cause currents to exist in the connected line and to ring the bell. A manually-operated short-circuiting commutator serves in lieu of the vibrator in another scheme.

A patent has been granted to Mr. G. Grabe, of Wilmersdorf, Germany, for a jack strip and jack of novel design. The arrangement is shown in Fig. 2. The jack springs pass through perforations in the rubber base strip instead of through the usual slots. The strip is stronger than a slotted strip and no screws are needed for securing the springs in position.

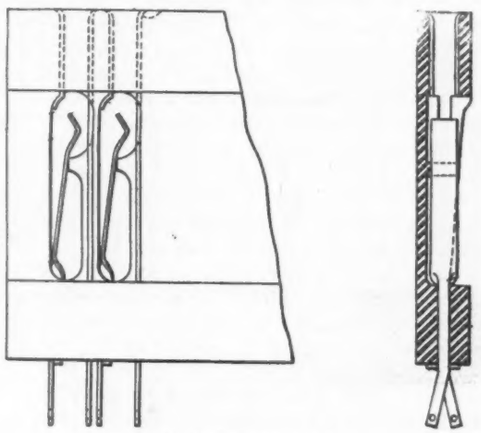


FIG. 2.—GRABE JACK.

The small carbon plates used in lightning arresters, while possessing so many good properties as to determine their continued use, have nevertheless always been subject to the disadvantage of short-circuiting owing to the dust formed by discharges. To obviate this difficulty, Mr. F. B. Cook has devised a means of coating the opposed surfaces with a celluloid cement. This fills the pores and depressions of the surfaces, but it is so wiped off as to leave exposed all raised points. The celluloid ash formed by discharges is said to be a non-conductor of electricity.

Letter to the Editors.

Defective American Street Lighting.

To the Editors of Electrical World:

Sirs:—I read with much interest Dr. Bell's comparison of European and American street lighting and your editorial comment on the same, and heartily agree that it is high time to make a radical change in American street-lighting practice. That European countries should have surpassed us in this respect, and particularly Germany, where a mark looms larger than a dollar, is little creditable to us. Undoubtedly the reason of this disparity lies in the primitive methods of dealing with the subject of street illumination in this country. Central stations have in this been largely at fault, in that they have viewed street lighting solely as a business proposition and not as an art; and without guidance, Councils have only considered the question when brought before them as they would one of street paving.

In the future it is hoped that central stations, in presenting street lighting propositions, will base them as largely as pos-

sible on illuminating considerations; and this may be done without calling for too much intelligence on the part of city authorities by presenting alternative plans for lighting the various classes of streets, accompanied by curves graphically showing the different values and distribution of light at street surfaces. In this connection the National Electric Light Association could perform a good work by fixing standards of illumination for different classes of streets, thereby enabling a central-station man to present a comparison between what he proposes and what the very best practice would indicate. At all events, something should be done to place street lighting in this country on a basis which will remove our inferiority in this respect to other highly-civilized countries.

Chicago, Ill. James L. Wright.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Irregularities of the Magnetic Properties of Steel Sheets.—E. Gumlich and E. Vollhardt.—An account of an investigation carried out in the German Reichsanstalt concerning the effect which the direction of rolling has on the magnetic properties of sheet steel. In all cases the steel was found to be much "harder" magnetically in a direction perpendicular to the direction of rolling, than in a direction parallel to the direction of rolling. This effect is manifest up to very high values of induction. The two curves in Fig. 1 are permeability curves of the same steel. The drawn-out curve gives the results of tests of samples cut from the sheets in a direction parallel to the direction of rolling. The dotted curve refers to samples cut in a direction perpendicular to the direction of rolling. The induction curves show a similar effect of the direction of rolling. On the other hand, there is hardly any effect on the electric conductivity and, therefore, on the eddy-current loss. The authors then investigated the effect of the method of cutting out samples from sheets on the magnetic properties. The following remarkable fact is finally mentioned: Ordinary dynamo steel had been annealed in April, 1907, in a gas furnace in the Reichsanstalt and was tested once in June and again in December. Although between June and December the steel had not been subjected to any treatment and had been kept at ordinary temperature, it was found to have deteriorated considerably during these six months. The coercive force was reduced by 7 per cent. The hysteresis loss for the maximum induction had increased by 3 per cent. The remanence was reduced from 13,700 to 10,300, the maximum permeability from 6700 to 4450, while the maximum induction had decreased by only about 100 units. As a matter of fact the test curves are so different that nobody would suspect that they relate to the same sample. The possibility of such enormous changes due to aging forms a serious source of error. Manufacturers should use only well-aged material, especially for instruments. The steel sample referred to was an ordinary unalloyed steel. It is probable that special silicon steels, which suffer a much less change of hysteresis loss with continuous heating, will also be found more constant with respect to permeability. The Reichsanstalt is making investigations of this point.—*Elek. Zeit.*, Sept. 17.

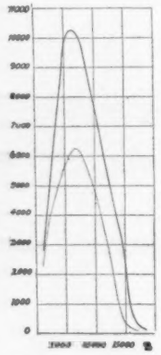


FIG. 1.—PERMEABILITY CURVES.

Excitation of Direct-Current Armatures with Alternating Current.—F. Eichberg.—The armature *A* (Fig. 2), wound like that of a direct-current machine, is placed in at two-pole field *S*. The brushes *B* and *B* are placed in the line of the magnetic flux *S*. The armature is excited by means of the brushes *b b* from the alternator *D*. The armature is mechanically driven. The two circuits *S* and *B B*, which have the same axis, are also magnetically coupled by means of the auto-transformer *t*, The ratio of the active numbers of turns may be $r = n_1 \div n_2$ in machine and $a = N_1 \div N_2$ in the transformer. The ratio x of a to r is called the coupling coefficient. According to the value of the coupling coefficient a speed can always be found for which the magnetic field *F* in the axle *b b* is excited with a minimum of volt-amperes. If x is infinitely large (if the brushes *B B* are removed), the speed corresponding to minimum volt-amperes is approximately equal to synchronism. If the coupling coefficient is positive and has a finite value, the speed of minimum volt-amperes is greater than synchronism. If the coupling coefficient is negative, the speed giving the minimum

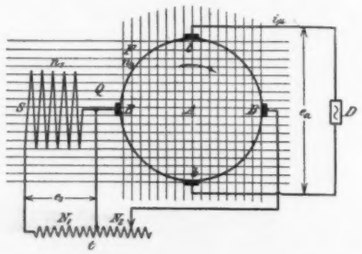


FIG. 2.—DIAGRAM OF ARMATURE WINDING.

volt-amperes is below synchronism. These results of experiments are explained theoretically. The author then discusses the behavior of the machine if an external e.m.f. is impressed on the transformer *t*.—*Elek. Zeit.*, Sept. 3.

Production of Heat in Electric Machines.—R. Goldschmidt.—A continuation of his long mathematical paper. The author gives first some examples on heat development in transformers. Reference is made to the well-known fact that the upper part of a frame is always hotter than the lower part. This is always the case with large apparatus if the material has not an excellent thermal conductivity. The explanation of this fact is given mathematically. Formulas are then given on the relation between the cooling effect and the speed of the ventilating air. The author then deals with liquid cooling agents, and discusses the calculation of the thermal resistance of insulated surfaces.—*Elek. Zeit.*, Sept. 17.

Single-Phase Commutator Motors.—R. Goldschmidt.—A continuation of his long illustrated serial. After having discussed the "ideal" motor, he gives the diagram of the real motor by taking account of the losses, but still supposes that the permeability of the magnetic path is so nearly constant that the flux is practically proportional to the current.—Lond. *Elec.*, Sept. 18.

Transformers.—A long illustrated outline of the transformer department of the General Electric Company, at Pittsfield, Mass., by W. A. Hall; a note, by W. S. Moody, on special transformer steel (silicon steel); and a note, by E. R. Pearson, on large shell-type transformers.—*Gen. Elec. Rev.*, October.

Cascade Converter.—A. Bloch.—An illustrated translation of his recent German article givin an explanation of the cascade converter and outlining its advantages over other forms of converters.—Lond. *Elec.*, Sept. 4.

Armature Reaction.—R. Swyngedauw.—A paper read before the International Society of Electricians in Paris on the armature reaction in direct-current dynamos. The author discusses successively longitudinal reaction, transversal reaction and the total reaction.—*La Lumière Elec.*, Sept. 5.

Interpoles.—Dollinger.—An illustrated article on some details of construction of commutation poles and their windings.—*Elek. Anz.*, Sept. 3.

Lamps and Lighting.

Photometric Standards.—R. D. GLAZEBROOK.—A British Association paper on the photometric standard of the National Physical Laboratory in London. It was shown by Paterson in 1904 that the relation between the candle-power of the 10-cp Vernon-Harcourt pentane standard at the laboratory and the humidity of the air is given by the equation: candle-power = $10 + 0.066\,(10 - e)$, where e is the amount of moisture present measured in liters per cubic meter of air, so that the standard condition is when 10 liters of moisture are present and the lamp has its nominal value of 10 cp. In Paterson's experiments the quantity e was measured (in nearly all cases) by an ordinary wet and dry bulb thermometer, and the observations reduced by the usual formula. At the Reichsanstalt an Assmann ventilating hygrometer is employed for the purpose, and the International Commission on Photometry recommended at Zürich the use of some ventilating hygrometer. This has led to a comparison of the two kinds of hygrometers in the still air of the photometer room, with the result that it has been shown that the ordinary wet and dry bulb instrument gives results some 20 per cent higher than the Assmann. The standard humidity, then, in the previous experiments, when measured by the Assmann, was 8 liters (not 10) per cubic meter, and Paterson's formula becomes: candle-power = $10 + 0.066\,(8 - e)$. The present paper discusses the question whether, since a change has to be made, it is desirable to retain the standard humidity at 10 liters, measured by an Assmann, and in consequence to change the light value, at any given humidity, of the National Physical Laboratory standard lamp by about 1.3 per cent, or whether it is preferable to retain the light value and change the standard humidity. The latter alternative is recommended. In this the gas referees concur. The changes which are involved, in consequence, in the value of the ratio of the pentane candle to the hefner candle, and to the bougie decimals are considered, and it is shown that, adopting as the basis of comparison the results arrived at by the commission at Zürich, and altering the standard value of the pentane candle to 8 liters humidity, the pentane candle and bougie decimals become practically equal, and each is equal to nine-tenths of the hefner. —Lond. *Elec. Eng'ing,* Sept. 17.

Quartz Lamp.—O. BUSSMANN.—An illustrated review of the most characteristic features of the new quartz lamp (mercury-vapor lamp in quartz tube). It is lighted by an automatic tilting device. When in full working order, the pressure of the mercury vapor in the lamp is 1 atmosphere. In the first moment of starting, the tube absorbs only from 25 to 30 volts, while it absorbs 180 volts when in full working order. A regulating resistor of iron wire is, therefore, provided in series with the lamp. To take care of sudden variation of the supply voltage, an inductance coil is also provided. The light of the quartz lamp is of a yellow-green color and can be improved on only by combination with carbon or metallic-filament lamps. The temperature of the poles containing the mercury is important; for this reason the poles are surrounded with cooling blades of sheet copper, the radiating surface of which can be adjusted.—*Elek. Anz.,* Sept. 10 and 13.

Generation, Transmission and Distribution.

Suction Gas Plants.—P. W. ROBSON.—A British Association paper on the production of cheap energy by suction-gas plants. The author first gives some figures of cost. In order to get the highest working efficiency, the steam supply should be regulated so that the temperature of the fire in the producer is kept as high as possible without making excessive clinker, because a richer gas thereby results, and the reversible reactions tending to the destruction of carbon monoxide are avoided. In all suction producers directly connected to the engine and automatically regulated thereby, successful working depends also upon the absence of any serious restriction to the flow of gas from the furnace to the engine cylinder. The author also explains the difficulty in the use of bituminous coal with suction-gas plant.—Lond. *Elec. Rev.,* Sept. 18.

Electric Equipment of a Brewery.—W. HAND.—An illustrated description of the electric equipment of the Anheuser-Busch brewery, in St. Louis. There are two generating plants centrally located, about 1200 ft. apart. A three-wire, direct-current system, with 220 volts between the outers, is used. Both steam plants operate condensing, with about 27 in. vacuum, at a steam pressure of 140 lb. The first station is equipped with two 500-kw, 250-volt compound-wound generators, each being driven by a vertical cross-compound engine; and two 300-hp steam turbines, each driving two 100-kw, 250-volt compound-wound generators. The neutral e.m.f. for this station is established by two balancer sets, one a 45-kw and the other a 20-kw machine. The second station contains two 500-kw, three-wire generators, and operates in multiple with the first station. Four hundred and forty-six motors are in use throughout the brewery, aggregating 4747 hp. About 900 hp more will be required to complete the electric drive of all the machinery.—*Gen. Elec. Rev.,* October.

Electric Motors in Gas Plants.—GERMERSHUSEN.—A long and profusely illustrated article on the use of electric motors in gas plants for conveying, crushing and other purposes. In many cases it is necessary to use enclosed motors. Brief descriptions are given of various electrical equipments of German gas works.—*Jour. f. Gasbel.,* Sept. 19.

Traction.

Electric Traction.—N. W. STORER.—An article in which the author gives a set of curves showing the results to be expected by the application of different gear-ratios to a certain motor equipment when operating in a given service. Two sets of curves are shown: the first set is plotted with the same initial accelerating current for all gear ratios, and the second set shows the result of accelerating at the same initial rate with all gear-ratios. The following general remarks are added: The only power supplied to the electrical-car equipment that may be termed useful is that required to overcome rolling friction and air resistance. The remainder of the power is expended in heating car wiring, resistance, motor, brake shoes and wheels. The "useful" power is usually a relatively small portion of the total in ordinary street and interurban railway service. The useful energy in watt-hours per ton mile may always be found by multiplying the train resistance in pounds per ton by 2. Thus, if the train resistance is 15 lb. per ton, the useful energy will be 30 watt-hours per ton mile. Fig. 3,

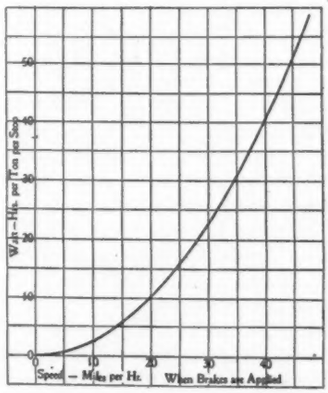


FIG. 3.—CURVE OF BRAKE LOSSES.

which refers to breaking, shows the advantage of allowing a considerable length of coast after cutting off the supply so as to apply the brakes at as low a speed as possible. It is extremely inefficient to apply the brakes immediately after the supply is cut off and make a slow stop. The energy loss in resistance where ordinary series-parallel control is used during one acceleration is approximately represented by the following formula:

$$L = \frac{A\,V\,T}{3600\,W}$$

where L = loss in watt-hours per ton, A = amperes per car with series position of controller, V = one-half line volts-drop in motor, T = time of acceleration in seconds, and W = weight

of car in tons. With a straight parallel control the loss in resistance will be almost one-half of the energy used during acceleration up to the time the resistance is cut out. The series-parallel controller cuts this down to about one-fourth. Thus, if the proper accelerating current for a given size of motor is used, the resistance losses will be increased with a higher speed gear-ratio, especially in slow-speed city service. The loss in resistance is generally reduced by increasing the rate of acceleration for a given gear reduction.—*Elec. Jour.*, September.

Electric Railways in Italy.—E. Giovannoni.—A review of the electrical operation of Italian railways. The electric operation of the Veltellina line (64 miles) and of the Milan-Porto Ceresio line (44 miles) has been so satisfactory that the electrical equipping of the lines given in the following list is now in progress:

Genoa-Pontedecimo-Busalla	12 miles
Tunnels in the Genoa district	7 miles
Savona-San Giuseppe	12 miles
Domodossola-Iselle	12 miles
Gallarate-Arona	15 miles
Milano-Lecco-Ponte San Pietro	56 miles
Gallarate-Laveno	19 miles
Bardonecchia-Modane	11 miles
Naples-Salerno-Castellamare	35 miles

Of these lines the first one is the most important, and it is expected that electric operation will begin in May, 1909. Electrical energy will be produced in a steam plant containing two 5000-kw turbo-dynamos, generating three-phase currents at 13,000 volts, the frequency being 15. The three-phase currents are transmitted to four transformer stations, reducing the voltage to 3000. At this voltage the current is supplied to the locomotives by means of two overhead wires, the method of suspension being similar to that in the Simplon tunnel. The rails are the third phase lead. The whole line is double-track. Electric locomotives rated at 1600 hp will be used for passenger and freight trains. The electric equipment of all the other lines mentioned above is expected to be finished by 1911.—*Elek. Zeit.*, Sept. 17.

Tramways and Omnibuses.—F. D. Fox.—A paper read before the British Association in which the author makes an attack on electric tramways. It is based on an analysis of 71 municipal tramways accounts, and its object is to show that there is a wide field for the electric trolley omnibus system, with which he is connected. He gives the average total cost, including capital charges, of the 71 municipal tramways, as 19.92 cents per car-mile, and the average revenue 21.04 cents per car-mile. For the gasoline bus the figure for total costs, including capital charges, is given as 23.4 cents per car-mile; for the "Electrobus," 20.50 cents, and for the trackless trolley car, from 14 cents to 18 cents. In the discussion very little attention was paid to these calculations, and no municipal tramway engineer or manager spoke. Sheardown suggested that the cost of the overhead line construction for tramways might conceivably be much reduced by using short brackets close to the poles and by improving the flexibility of the trolley arm.—Lond. *Elec. Eng'ing*, Sept. 17.

Swiss Mountain Railway.—The Interlaken-Lauterbrunnen-Wengern Alp-Grindelwald rack-and-pinion railway, which is at present worked by steam, is in process of conversion to electric traction, and it is stated that the system to be adopted is the overhead trolley with continuous current. The line, which is about 15 miles long, rises to a height of 6700 ft. above sea level. The conversion to electrical working is being made largely with a view to fuel economy, since ample waterfalls are available for the generation of electrical energy.—Lond. *Elec.*, Sept. 18.

Melbourne.—C. H. Merz.—His report on the proposal to convert the suburban railways of Melbourne to electric traction. The route length is not less than 124 miles. A preliminary equipment of 29 miles of track is recommended, with the direct-current third-rail system at a pressure of 800 volts; converter substations to be supplied with three-phase currents from a 35,000-hp steam-turbine generating station.—Lond. *Elec.*, Sept. 18; Lond. *Elec. Eng'ing*, Sept. 17.

Baden Railways.—A note stating that the government of the State of Baden, in Germany, has decided to introduce electric traction on the sections of the State Railway line between Basel and Zell, and between Schopfheim and Säckingen. The "Siemens-Schuckert system" is to be adopted, and the electric energy will be supplied from special stations to be erected near the Rhine. Ten 1000-hp electric locomotives have been ordered in the first instance.—Lond. *Elec.*, Sept. 18.

Installations, Systems and Appliances.

Operating Cost of Stations.—Engelmann.—A paper read before the Electrical Society of Frankfurt. It makes a great difference in a station whether machinery must be kept running for 24 hours a day or perhaps 15 or 18 hours only. In the latter case, two shifts of men are sufficient; in the former case three shifts of men are necessary. For this reason direct-current stations with storage batteries are distinctly superior under certain conditions to alternating-current stations except in the case of very large plants. In such stations in which a lighting load prevails, the excess of the load in the evening must be furnished from special machines and for these extra machines, which run only comparatively few hours in a year, it is far more important to keep the first cost, interest and amortization at a low figure than operating cost. In water-power plants it may be in such cases preferable to use steam turbines as extra machines if they are less expensive than the development of further water power would be. According to the statistics of German central stations, the operating expenses (including fuel, wages, maintenance and repairs, office expenses, taxes, etc., but not including interest and amortization) per kw-hour sold vary from 0.75 to 12.5 cents. The higher figures of cost, however, are found only in comparatively small stations. The author then gives statistical data on the operating expenses of German stations as a function of the load factor. It is found that the results of practice are presented by quite regular curves. A plant of 1000 kw is able to furnish in the 8760 hours of the year 8,760,000 kw-hours. If it sells only 876,000 kw-hours the load factor is 10 per cent, and the "hours of use" of maximum capacity is 870 hours in the year. These two figures are given as the abscissas of Fig. 4, while the ordinates represent cents

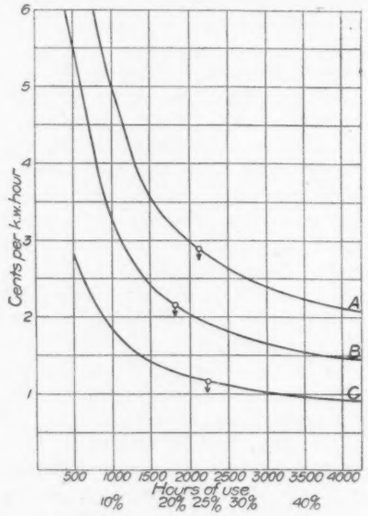


FIG. 4.—OPERATING COSTS.

per kw-hour. The three curves relate *A* to stations of 235 kw, *B* to 550 kw, and *C* to 4450 kw. The great importance of a high load-factor is evident. Especially such stations which have a load factor of less than 25 per cent will gain much by raising the load factor. To accomplish this a proper tariff can do much. A double tariff which charges two or three times as much for evening hours as for the balance of the day is dangerous, since it may cause people to use gas in the evening. The author favors a tariff like that of the city of Halle, in Germany. It is a fact that many lamps are installed in residences, although comparatively few of them are used. In Halle a discount is allowed if a certain number of these lamps are lighted simultaneously. For this purpose not only an

ordinary meter, but also a time-meter is installed. The latter measures the hours of use, but only if a certain number of lamps are lighted simultaneously. Up to 300 hours of use measured in this way, the kw-hour costs 15 cents; above that it costs only 5 cents.—*Elek. Zeit.*, Sept. 17.

"Peculiar Ground."—R. W. CRYDER.—After operating a 35-kw motor-generator set successfully for several days, it was discovered that when the conduits at the rear of the switchboard were disturbed, arcing occurred between them. It was immediately inferred that the motor, or the wires in the conduits connecting the motor to the switchboard, were grounded and that the arcing between the conduits was due to this ground. The motor operated on a 650-volt railway circuit, a tap running from the third-rail to the positive curcuit-breaker on the switchboard, and a second one from the negative or ground rail directly to a switch mounted on the frame of the motor. The wire connecting this switch to the negative rail was insulated and laid in loricated conduit; it was about 75 ft. in length. The motor and wires in the conduits were tested and found to be free from grounds. Examination was then made of the wire connecting the negative switch to the ground rail, and it was discovered that the connection between the wire and rail had been removed. The negative line was thus broken, but the circuit was, by chance, completed by a steam pipe which lay against the conduits and accordingly the motor continued to run. It was apparent that any disturbance to the conduits would cause arcing between them as the circuit was thus opened. The negative wire was again attached to the rail, the supposed ground removed and no more trouble was experienced.—*Elec. Jour.*, September.

Synchronizing.—H. W. BROWN.—The author describes the magnetic-vane type and the motor type of synchroscope, and gives the different diagrams of the connections for synchronizing to one set of busbars, for synchronizing to either of two sets of busbars, for synchronizing around switches, and for synchronizing between machines. He finally deals with automatic synchronizers, with one set and with two sets of busbars. —*Elec. Jour.*, September.

Motor and Transformer Troubles.—W. NESBIT.—Notes describing troubles experienced with a direct-current motor due to a broken wire in a field coil, also troubles with transformers due to various causes. Among the different causes were a broken high-tension lead to one of several parallel transformers; lack of sufficient oil in a transformer case, and wrong connections of transformers having series-parallel connections. —*Elec. Jour.*, September.

Double-Deck Turbine Stations.—An article summing up the characteristic features of double-deck turbine stations, dealing especially with the arrangement of the boiler plant, steam piping, condensers, generating plant, switch room and auxiliaries. Finally an analysis of costs is given.—*Elec. Jour.*, September.

Electrophysics and Magnetism.

Helium and Radium.—J. DEWAR.—An abstract of a British Association paper on the amount of helium evolved from radium. He announced that he has discovered that Crookes' radiometer can be used as a very sensitive pressure gage. He connected a radiometer with a bulb filled with charcoal and immersed in liquid air. The great exhaustion thereby produced sufficed to stop the radiometer even when illuminated by an arc lamp. On attaching a tube containing dry perchlorate of potash, and evolving pure oxygen from it, it was found that the radiometer begins to work at one fifty-millionth of an atmosphere, equivalent to the vapor pressure of mercury at -23 deg. C. The Macleod gage reads only down to double that pressure. He applied the new method to determine the amount of helium evolved from 70 milligrams of radium bromide, and found the amount to be 0.37 cu. mm per gram of radium per day, which strikingly agrees with Rutherford's theoretical value of 0.3 cu. mm. He asked Strutt if he still thought all helium to be evolved by diffusion from rocks. R. J. Strutt maintained that the earth would not be capable of retaining helium in its atmosphere, and that only an underground source could account for the amount of helium present in the atmosphere. In reply, Dewar mentioned that Bryan had shown that gases having the atomic weight of helium are heavy enough to be retained by the earth.—Lond. *Elec. Eng'ing*, Sept. 17.

Electrochemistry and Batteries.

Electro-Analysis.—H. J. S. SAND.—An abstract of a British Association paper on the rapid electro-analytical separation of metals. The author gave a demonstration of a process of electro-analysis, in which the principle of very vigorous stirring of the electrolyte has been combined with that of keeping the potential of the cathode under control by means of an auxiliary electrode. It has thus been possible very largely to extend the scope of electro-analytical methods. The following metals have hitherto been studied: First, the metals of the silver and copper groups and zinc; that is, silver, mercury, copper, bismuth, lead, cadmium and zinc. All of these metals have been deposited singly, separated from each other, and also separated when all were present in the same solution. In the last-named case the quantity of each metal taken varied between 0.10 and 0.15 gram, and the time for the deposition of each was between 10 and 15 minutes. Secondly, new methods have been elaborated for the determination and separation from each other of antimony and tin. A considerable number of determinations have been carried out in which the metals taken in varying ratios weighed together approximately 1 gram. The time for the deposition of the antimony was usually about 20 minutes; that for tin about 80 minutes. Lastly, an examination has been made of the possibility of securing a purely electro-analytical method for the analysis of an alloy consisting of copper, antimony, lead and tin, and all the separations required for such an analysis have been carried out.—Lond. *Elec. Eng'ing*, Sept. 17.

Units, Measurements and Instruments.

Measurement of Power Factor.—C. V. DRYSDALE.—The author discusses the measurement of power factor with reference to a recent article by Lulofs. The most convenient method for determining the power factor in a three-phase circuit is to employ a double wattmeter, as in Fig. 5. In this case the true

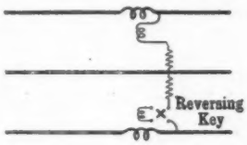


FIG. 5.—DOUBLE WATTMETER METHOD OF MEASUREMENT.

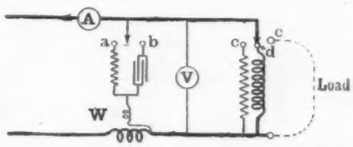


FIG. 6.—CONNECTIONS FOR TEST.

watts $w = w_1 + w_2$ are directly given by the instrument reading, while if either the shunt or series coil of one wattmeter is reversed by a simple commutator a reading $w' = w_1 - w_2$ is obtained, so that $\tan \Theta = \sqrt{3}\frac{w'}{w}$. This method is particularly convenient and accurate when testing induction motors and three-phase transformers. With low voltages the whole of the shunt circuit may be reversed, but with high voltages the moving coil only or the main coil must be reversed to avoid a high potential difference between the fixed and moving coils. For single-phase measurements the author points out that the ideal method of using a wattmeter would be one in which the current in the pressure circuit was simply displaced by 90 deg. without altering its value. The nearest approach to this ideal condition is to substitute a condenser for the series resistor of the pressure circuit of the wattmeter. The most convenient arrangement is shown in Fig. 6. The circuit contains an ammeter *A*, voltmeter *V* and wattmeter *W*, the latter being provided with a condenser and key by which it may be substituted for the series resistor in the pressure circuit. In addition to the load to be tested, a non-inductive resistor is provided, and a highly inductive coil, the power factor of which is known to be less than 0.1 (almost any solenoid with a good laminated divided iron circuit will do). A three-way switch

allows either the load, resistor or inductance to be thrown into circuit at will. Three simple preliminary measurements will then serve for all purposes, as follows: (1) Switches on *a* and *c*: The wattmeter, if direct reading, should then agree with the product of the amperes and volts, if not a wattmeter constant $k = V C/w$ is obtained. (2) Switches on *b* and *d*: The wattmeter shunt and main currents may then be considered sufficiently nearly in time-phase to take the new wattmeter constant for lagging currents as $k' = V C/w$. Then the ratio of the constants will be $f = k'/k$. (3) Switches on *b* and *c*: The main current is in time-phase with the voltage, and the shunt currency nearly in time-quadrature with it. A small wattmeter reading *w* will be obtained, whereas with a similar current in time-phase it would have been $V C/k'$. Hence, tan $a = \sin a = k'w/V C$ approximately. Then for readings with any load $\tan \Theta = f\frac{w'}{w} + \tan a$, where *f* and tan *a* are given as above. This formula should be used for small angles of lag or lead and the ordinary formula, $\cos \Theta = k w/V C$, for large angles.—Lond. *Elec.*, Sept. 18.

Manganin Resistors.—F. E. Smith.—An account of an investigation carried out in the National Physical Laboratory, in London, concerning the variation of the resistance of manganin resistors with atmospheric humidity. His observations do on the whole support the conclusions arrived at by Rosa and Babcock, and it seems that coils hermetically sealed or coated with a varnish which does not absorb moisture, must have an advantage over manganin coils coated with shellac. The fact that some high-resistance coils exhibit the "humidity effect" to a negligible extent only, points to the possibility that a shellac varnish may be prepared, which, after baking, is not appreciably hygroscopic.—*Phil. Mag.*, September.

Measurement of Inductors of Large Inductance Containing Iron.—Oliver Lodge and B. Davies.—A British Association paper in which the authors state that they have lately measured inductances up to and above 100 henries, the cores of the inductors consisting of subdivided iron in nearly close circuit, as used for certain telegraphic purposes with very weak currents. Since the inductance may vary rapidly with strength of current it is necessary in any measurement to imitate the conditions of practice, and determine the inductance as a function of current under those conditions. To this end they have designed a maximum-amplitude galvanometer, consisting of a well-damped coil, moving dead-beat in a strong magnetic field, and attached to a mirror so that the amplitude of its excursion can be observed. It can, consequently, be calibrated by means of a steady current giving the same deflection. The inductor of which the inductance is to be measured is connected in series with this galvanometer, and with a specially designed alternator of small power and known frequency, $p/2\pi$, giving a sinuous or simply harmonic current. A switch allows the inductor to be suddenly replaced by a non-inductive adjustable resistor R'; and when, under these conditions, the same oscillation is produced in both cases, then the self-inductance is equal to the equivalent resistance divided by the frequency constant, or $L = R'/p$. The strength of the current evolved in this measurement is known by imitating the deflection with a known steady current, and the main measurement consists simply in observing the deflection caused by the sine-alternator, at a measured frequency, either with the inductor or with the adjustable non-inductive resistor, indiscriminately. It is to be understood that the resistance of the wire wound on the inductor is low. If not, a correction must be applied. The following empirical expression is found to give the self-induction of a nearly closed magnetic circuit excited only by very weak currents, since for such currents it is found to be practically constant:

$$L = \frac{kn^a}{(G+g)^b}$$

where *n* is the number of turns, *G* the width of the air-gap in millimeters, and the other quantities are constants to be determined by experiment, though *a* will be nearly 2. The result of this method of measurement applied to inductance coils of this type shows: (1) that measurements based on a determination of the square root of mean square of current would serve fairly well for low magnetizing forces; (2) that the self-inductance of such coils for weak currents is nearly independent of frequency, or, say for all frequencies up to about 20 per second, when the magnetizing force does not exceed 0.04 c.g.s.; (3) that the self-inductance of a nearly closed magnetic circuit is a definite and dependable function of the width of the air-gap for moderate currents and frequencies.—In full with illustrations in Lond. *Elec.*, Sept. 11; abstracts in Lond. *Elec. Eng'ing*, Sept. 17, and Lond. *Elec. Rev.*, Sept. 18.

Telegraphy, Telephony and Signals.

Frequency of Telephone Currents.—Deveaux-Charbonnel.—An account of an experimental investigation concerning the frequency of telephone currents. The author first studied the vowels by taking oscillograms which do not indicate parasitic oscillations due to the diaphragm of the microphone. When the curves are plotted by means of the oscillograph it is easy to resolve them into fundamental waves and higher harmonics. The author finds that in vowels the fundamental wave has a smaller intensity than the harmonics and that each vowel is characterized by the presence of a special harmonic. The second harmonic dominates in the vowels *i*, *u* and *e*, the sixth in *a* and the fifth in *o*. Moreover, the higher harmonics 9 and 13 appear in the vowels *u* and *i*. Human speech seems to be "a succession of oscillating phenomena, the greater part of which is regularly periodic." On the other hand, by extinguishing certain harmonics by means of self-inductances or capacities, he finds that not all higher harmonics are of the same importance for the intelligibility of the speech and that the presence of only a small number of the harmonics is indispensable. A mean frequency of 1000 appears to be a fair value on which to base the study of practical problems of telephony.—*La Lumière Elec.*, Sept. 12.

Telephone Transmission.—A. Sabatier.—In small telephone installations the transformer coil is generally suppressed and the microphone is connected in series with the battery and the line and receiver. The author recommends the connection of the microphone in parallel with the battery and shows that in this way the range of transmission may be extended without making use of a transformer coil. He gives the formulas for this connection and applies them to some numerical examples.—*La Lumière Elec.*, Sept. 12.

Miscellaneous.

Lubrication.—C. H. Julius.—A paper on the lubrication of motor bearings, journal bearings and gearing on electric cars. Grease is very effective in reducing the noise of the gears, especially when they are somewhat worn, owing to a defect in the mounting or unequal wear in the two armature bearings so that the gear and pinion do not mesh properly. The addition of sawdust or graphite contributes to the reduction of noise. Purely as a lubricant grease is inferior to oil. Just as in bearings, the reduction of friction is obtained more easily by means of a liquid lubricant, like oil. Wicking, which furnishes a regular supply of lubricant, is preferable to a bath of oil. Tests are also recorded of a special patent lubricant.—*Elec. Railway Jour.*, Sept. 19.

New Thermit Reactions.—H. Goldschmidt.—A paper read before the German Bunsen Society. In his well-known aluminothermic method, the aluminum (used as the reducing agent) may be replaced by calcium-silicon or magnesium-silicon or aluminum-calcium.—*Electrochem. and Met. Ind.*, September.

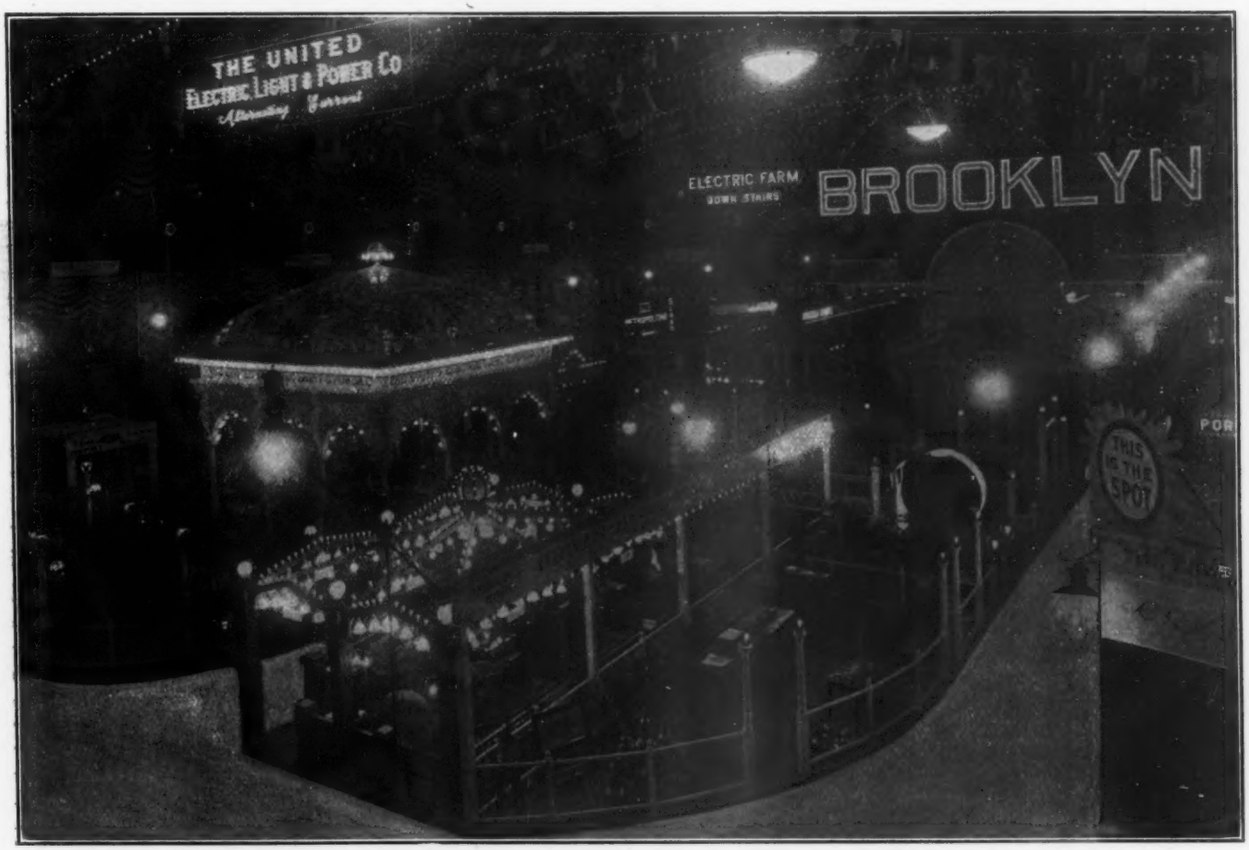
Cascade Converter.—A. Bloch.—An illustrated translation of his recent German article giving an explanation of the cascade converter and explaining its advantages over other forms of converters.—Lond. *Elec.*, Sept. 4.

New Thermit Reactions.—H. Goldschmidt.—A paper read before the German Bunsen Society. In his well-known aluminothermic method, the aluminum (used as reducing agent) may be replaced by calcium-silicon or magnesium-silicon or aluminum-calcium.—*Electrochem. and Met. Ind.*, September.

NEW APPARATUS AND APPLIANCES

Exhibits at the New York Electrical Show.

The exhibits at the New York Electrical Show which is being held in Madison Square Garden this week and which closes on Oct. 14, while not all-comprehensive are nevertheless creditable to the industry and show many new applications of electricity in the lighting and power fields. The applications of electricity are so many and so varied that it is out of the question to portray adequately to the lay mind in a popular exhibition the length, breadth, depth and height of the industry. However, the show is intended primarily for the general public which, while it may not care to be impressed with the enormity of electrical applications, is always interested in things electrical, even though electricity bears only a remote connection with the apparatus displayed at times. In the present show the industrial, commercial and domestic fields are all represented, so that the engineer as well as the novice can find much of interest. Appended herewith are short descriptions of the exhibits.



GENERAL VIEW OF THE ELECTRICAL SHOW, MADISON SQUARE GARDEN, NEW YORK.

THE METROPOLITAN ENGINEERING COMPANY, of Brooklyn, N. Y., is represented by a full line of its electric signs. A feature of the exhibit is a new illuminated cornice sign, which can be erected above or below the cornices of buildings. The signs are well made and enameled. Other standard signs are shown in various sizes and finishes. The company is represented by Mr. R. M. Mann, assisted by an efficient staff of salesmen.

ELECTRICAL WORLD occupies a prominent space on the main aisle near the entrance to the Garden. Copies of the ELECTRICAL WORLD and of the other publications of the McGraw Publishing Company are distributed to those interested in their pages, and a representative collection of engineering books published by the company is on exhibition and sale. Editorial and business representatives of the ELECTRICAL WORLD are in attendance, as well as representatives of the book department.

HABIRSHAW WIRE COMPANY, Yonkers, N. Y., exhibits samples of wires and cables for various voltages, etc. A feature of the exhibit is a sample of the largest telephone cable built for submarine purposes. This comprises 100 circuits of standard No. 16 B. & S. gage wire in pairs, taped, leaded, covered with a heavy surfacing of jute and double steel armor and heavy compound. Samples of electric cables for direct-current and alternating-current work as well as for telephone, telegraph and automobile work are suitably labeled for the benefit of visitors. The exhibit is in charge of Mr. J. B. Olson, secretary of the company; Mr. R. S. Satterlee, second vice-president, and Mr. W. W. Thomb, assisted by Messrs. H. Stevens, W. Kametz, Newel and Obermeyer.

EXCELLO ARC LAMP COMPANY, New York, is represented at the exhibition by Messrs. Hirschberg, Armstrong, Thompson, Fiske, Hanley, Sundstrum and Laidman. The company has four of its lamps on exhibition in its booth, two of which are intended for operation in series on direct-current circuits, one in multiple on direct-current circuits and one in multiple on alternating-current circuits through a transformer. Eight of the company's pearl white flaming arc lamps are arranged around the balcony of the arena, eight others are distributed under the portico around the front of the garden; four in the basement, where the cows are being milked; five on the parapet around the summer roof garden, and four in the tower near Diana.

Meade Company, New York, has on exhibition invincible electric cleaners, and a compressed air system for cleaning carpets. Messrs. D. Miller, J. McAnerney and Graham are in attendance.

International Textbook Company, Scranton, Pa., exhibits all the printed matter, books, etc., used in connection with its correspondence course in electricity. The exhibit is in charge of Mr. J. H. Martin.

The Watson-Stillman Company, of New York, has a number of turbine pumps and medal presses on view. There are six electrically-driven pumps of various sizes as well as hydraulic jacks and shaft straighteners shown in actual operation. Messrs. G. L. Gillen, E. A. Johnson and H. A. Prindle are in attendance.

The Simes Company, New York, manufacturers of electric and combination fixtures, has a display of tungsten fixtures and portables for ordinary incandescent lamps on exhibition. The fixtures have various finishes and art-glass and silk shades add attractiveness to the display which is in charge of Mr. P. T. Coburn.

Tel-Electric Music Company, New York, exhibits a number of tel-electric piano players in a small apartment. The actuating mechanism of this piano player is entirely electric and is contained in a small case, which may be placed on a convenient stand or table. Various attachments enable the operator to produce all the musical expressions.

Lamson Consolidated Store Service Company, Boston, Mass., exhibits working models of its pneumatic system for department store and other service. The motor-driven suction apparatus is very compactly arranged in a cabinet. An electrically-driven pick-up system for letters, packages, etc., is also shown in operation. Mr. J. F. Soby represents the company.

Fox Brothers & Company, New York, feature the Carbone lamp, a 50-hour Radiante lamp, Polar flaming arc lamps, Radiante economy lamps and Philips tungsten lamps. The lamps represent the latest types in their class and possess many valuable and distinguishing features. The exhibit is in charge of Mr. Louis J. Auerbacher, who is assisted by Messrs. H. C. and F. F. Fox.

Spencer Turbine Cleaner Company, Hartford, Conn., shows two of its turbine cleaners; these are adapted for use in dwellings, hotels, theaters, power plants or railways. The turbine cleaner is a simple, efficient device requiring little space, little attention and little energy, and is looked upon as being one of the most serviceable of modern electrical conveniences. Mr. E. W. Muzzy represents the company.

German-American Electric Company, New York, displays a number of Grant flaming arc lamps. The distinguishing feature of this lamp is that it has no clockwork, gears, clutches, shunt coils, resistors or dashpots, the electrodes being fed forward by gravity alone. The lamp is only 26 in. high and uses 24 in. electrodes. It weighs about 20 lb. In addition the company has six of its lamps suspended in the arena. Mr. Lambert Schmidt is in attendance.

G. M. Gest, New York City, displays typical views of conduit installations and samples of his well-known cable rack. The H. B. Camp Company also exhibits in this space samples of its single and multiple duct conduit. Mr. Gest has brought out a new reinforced feeder pole consisting of an iron pole lined inside with concrete and having a concrete base. The representative of Mr. Gest is Mr. E. W. Tillson, and Mr. C. Reier is the representative of the Camp company.

Edison Business Phonograph Company, Orange, N. J., exhibits its latest forms of phonographs for business purposes. The company now uses a simple series motor, having a thoroughly laminated structure with a series resistance of 1000 ohms, so as to make the phonograph applicable to both alternating and direct-current circuits. Until recently these phonographs could only be operated from direct-current circuits. The series motor is a model of its kind and operates on 35 volts. Mr. Nelson C. Durand, the manager of sales, assisted by a number of representatives of the company, is in charge of the exhibit which occupies a large space in the gallery.

Enos Company, New York City, N. Y., makes a display of chandeliers fitted with a new type of glassware especially designed for high-efficiency lamps. This is an opal glass with a satin finish, and on the back of the booth curve sheets are hung showing the distribution of light from various lamps fitted with the glassware. Five types of fixtures and six styles of glassware are on display. Messrs. E. L. Cox, H. M. Slauson, F. R. Jones and B. G. Loomis are the representatives of the company.

Commercial Utilities Manufacturing Company, New York City, N. Y., exhibits in the gallery a number of its electric time stamps. A feature of the exhibit is the flush type of stamp used by the cable companies, which gives the time the messages are received, the signature of the operator and the number and letter of the cable over which it is transmitted. The time stamps are controlled by a master clock and do not possess any clock mechanism. The type wheels are operated electrically and the stamp prints an impression in a straight line and sets itself automatically to the proper day, hour and minute. The company is represented by Messrs. W. J. English, G. Roos and E. C. Whitton.

Electric Motor & Equipment Company, Newark, N. J., besides the booth display has a four-line 60-monogram sign directly over the entrance to the arena. This sign covers a space 25 ft. x 40 ft. and on it are shown the advertisements of the various exhibitors. The sign is in operation from 3 to 6 and from 7 to 11 o'clock in the evening and each flash is shown at intervals of six seconds. There are 21 lamps in each monogram, or 1260 lamps in all, and an equal number of lamps is arranged in a large border surrounding the entire sign. A motor-driven commutator is used for each monogram and the sign is said to be the largest ever erected for advertising or for private enterprises. The company's booth shows various types of sign construction. Among these is the ordinary raised-box letter, flush letter type of construction with various color combinations in paint and a new type of iron-clad sign. The latter consists of an enameled steel face plate fitted with receptacles made by the company. The letters in the sign can be changed at will. Four models of the company's flashers are shown in operation as well as two types of transparencies. Mr. S. H. M. Agens is in charge of the exhibit and he is assisted in explaining the features of the various signs and flashers exhibited by Messrs. A. Lion, E. B. Wolf, G. E. Davis, F. Rossiter, W. F. Georges, F. E. Bailey, W. Dixon and A. Graham.

Simplex Electric Heating Company, through Roger Williams, its New York agent, is making a very elaborate display of its heating devices. A new line of percolators in copper finish forms a feature of the exhibit. A new range larger in size than any previously built completes a line of 12 standard ranges. The company has also brought out a new cord support by means of which the cord of a flat iron is not in the way of the operator. A signal lamp which indicates when the iron is in circuit is also a new feature of the flat iron exhibit. A three-gallon percolator and a new hot water heater which can be attached to the ordinary hot-water kitchen boiler is shown. Other devices on exhibition include a plate warmer for pantry service, bath room heater finished in baked enamel, dining room set consisting of a combination of percolator, tea kettle and chafing dish fitting on the same heater, radiators finished in baked enamel for steamship use with guard to protect draperies, etc., plate warmers for serving table use in hotels, 20 different types of irons and a complete line of regular heating apparatus. The company has just issued a 128-page catalogue which is the most complete book devoted to heating apparatus thus far issued. The company manufactures over a hundred different types of irons and only a few samples of its product can be shown in the space at the Garden. Demonstrators are in attendance explaining the operation of the various appliances. Messrs. H. K. Stiles and H. A. Quackenbush are present in the interests of the company, and Mr. James I. Ayer, the well-known heating expert and manager of the company, was a visitor.

BLACKALL & BALDWIN COMPANY, New York, has on exhibition a number of "Cleanators." This is a very compact vacuum cleaning set comprising a motor-driven vacuum machine and a water filter for catching the dust. Two instruments are shown in operation. Mr. T. W. Kloman explained their merits.

CAMPBELL ELECTRIC COMPANY, Lynn, Mass., displays a number of time switches, transformers for bell circuits and sign flashers. The company's apparatus is pretty well known to the trade and judging by the interest evinced by visitors also possesses advantages which appeal to the general public. The booth is in charge of Mr. C. P. Cook.

MARCONI WIRELESS TELEGRAPH COMPANY exhibits a full-size Marconi transmitting and receiving shore station set, including a 2½-hp engine belt-connected to a 2-kw alternator. This equipment is said to be capable of communicating at a distance of 250 miles. On the gallery at the other end of the arena a complete ship outfit is installed and messages are transmitted from station to station.

THE HEANY COMPANY, of York, Pa., has its interests looked after by Mr. Edward J. Simon and Mr. W. A. Ernst. The Heany metallic filament tungsten lamp is shown, as well as samples of Heany fireproof wire for various purposes. Long life and low specific consumption are the claims made for the lamp and indestructibility within practical limits is claimed for the asbestos-covered wire used in dynamo and motor work.

ELECTRIC HOME SUPPLY COMPANY, New York, dealer in electrical appliances for the home, has a well-equipped booth on the right hand side of the arena. Among the numerous devices shown in operation are the Dim-a-Lite regulating socket. Pacific irons, toasters, curling irons, a laundry iron with a hot point, Shelton vibrators and hair drier. The company makes a specialty of equipping houses with electric heating appliances. The exhibit is in charge of Messrs. Max Lowenthal and C. D. Wood.

GOULDS MANUFACTURING COMPANY, New York, has a number of triplex pumps on exhibition, some of which are direct connected with motors, others are belt-connected, while still others are connected with motors through reduction and worm gearing. A motor is shown in operation pumping water into a tank which is fitted with a float switch, so that the automatic feature of the outfit may be seen in actual operation by visitors. Messrs. W. E. Dickey and W. H. Hopper represent the company.

MANHATTAN ELECTRICAL SUPPLY COMPANY, New York, has a full line of its electrical specialties on display. The line includes medical apparatus, vibrators, ignition supplies, dry batteries, telephone and telegraph instruments, time switches, desk fans, small motors and generators, bells, alarm clocks, burglar alarms, decorative lamp outfits, separable cap wall receptacle for molding and a separable attachment plug. Messrs. J. C. Moulton and J. Nelka are in attendance.

NEUMATICON COMPANY, of New York, exhibits a portable vacuum machine arranged in compact form for utility and saving of space. The device weighs about 38 lb. and the mechanism which is contained in a cabinet consists of an electric motor driving a series of turbines which suck the dust into a receptacle containing water. Among those in attendance demonstrating the capabilities of the machine are Messrs. S. Markstein, M. May and H. B. Morton.

NATIONAL VACUUM COMPANY, New York, exhibits a complete motor-driven vacuum cleaning apparatus which is enclosed in a cabinet. The weight of the machine is such that it can be carried from floor to floor. The rotary pump has two working parts and such wear as may take place in its blades is said to be self-adjusting, so that there is no loss of vacuum due to wear. The motor is placed at the bottom of the cabinet and the pump at the top of the cabinet, the dust receptacle intervening. Suitable fittings for cleaning walls, ceilings, furniture, carpets, bedding, etc., are a part of the outfit. The company is represented by Mr. S. S. Baldwin and Mr. C. H. Corbitt, Jr.

OTIS ELEVATOR COMPANY, New York. This company exhibits in a space at the end of the right aisle of the arena a model automatic elevator such as is used in private dwellings. The machine is subject to double push button control, there being a push button on each floor and a series of push buttons in the elevator itself. As is well known, all the safeguards possible are provided in this equipment and a feature not possessed in the older equipments is the slowing down of the elevator as it approaches the desired landing. The magnet controller, push buttons, electric door protector and mechanical lock are all shown in operation. In addition to the exhibit in its own space, the company has an exhibit in the booth of the United Electric Light & Power Company, consisting of a two-phase elevator motor and a single-phase magnet controller. The exhibit is in charge of Mr. M. Baldwin, who is assisted by Messrs. W. D. Lutz, W. B. Denton, G. M. Malcolm and other representatives.

DRIVER-HARRIS WIRE COMPANY, of Harrison, N. J., makes the display of "Nichrome" wire the feature of its exhibit, which also includes coils of the various wires made by the company. The alloy nichrome has a resistance stated to be 60 times that of copper and more than three times that of German silver, the latter being still widely used for resistance wire. Nichrome is non-corrosive, so that wires made from it are especially applicable for arc lamp resistances, commercial resistance units, rheostats and controlling apparatus in general. The wire, because of its excellent properties, also finds a wide use in heating and cooking utensils. The alloy is worked to above red heat up to 1500 deg. Fahr. without danger of disintegration, brittleness or scaling. Another product of the company featured at the exhibition is its "Advance" copper-nickel wire which is used for delicate measuring instruments. The company's complete line includes many alloys of high specific resistance possessing besides this quality ductility, high melting point, homogeneous structure, low temperature coefficient, low thermo-electric effect, etc. As yet no single alloy possesses all of these qualities; but the company has wires adapted to various lines of work in which one or more of the above properties are desirable and these are shown in the large booth of the company to the right of the main entrance. The exhibit is in charge of Mr. Arlington Bensel, assistant treasurer and sales manager, assisted by Messrs. Wilmot H. Kissam and L. O. Hart, of the engineering staff of the company. A wire scale of high-resistance wires suitably encased in a celluloid case is distributed as a souvenir.

THE MURPHY ELECTRICITY RECTIFIER COMPANY, Rochester, N. Y., exhibits an entirely new alternating-current rectifier. In this a synchronous motor works in step with the line alternations. On the shaft of the motor is a cylinder of insulating material on which are two metallic points. On holders which can be revolved around the axis of this insulated cylinder are four metallic points, and there are in addition four rectifying disks revolved by the motor. The secondary wires of a specially constructed transformer are connected to two condensers shunted across the circuit. The storage battery to be charged is connected between the line transformer and the specially constructed transformer, making connection also with the condensers. The synchronous motor is brought up to synchronous speed by cranking, after which a switch controlling the primary circuit of the specially-constructed transformer is closed and the rectifier is at work. When two points on the insulated cylinder are opposite two points on the holders which are revolved around the axis of this cylinder, one of the condensers discharges through the air gap between the points and also through the air gap between the rectifying disks, permitting the line current to flow to the battery. In the next half cycle the points on the insulated cylinder are brought opposite to the other two points on the holders and the other condenser discharges so that the circuit is again completed to the battery. By means of a rocker arm the points in the holders can be revolved around the axis of the cylinder so that the condenser discharge can take place at any point of the wave of the impressed voltage. In this way the direct-current voltage can be regulated through a wide range. The rectifier is equipped with an automatic device which operates when a predetermined voltage has been reached. Enclosed in the same case is another protective device which operates when an abnormal current passes through the rectifier. Two rectifiers are shown in operation charging a 30-cell battery. The machines are operated in multiple and the exhibit is in charge of Mr. T. J. Murphy, the inventor of the apparatus.

Stanley & Patterson, New York, feature the Patterson dry battery holder by means of which a set of dry batteries can be placed in circuit without the use of wire connectors, all the connections being made in the battery holder. An automatic bridge in each cell receptacle permits the removal of one or more cells without interrupting the circuit. The holders are adapted to automobile, boat and domestic use and are a convenience which users of dry batteries will appreciate. Mr. F. Eastman and Mr. G. L. Patterson are in attendance.

Federal Electric Company, New York and Chicago, has a number of its well-known signs on exhibition. These include 16-in. and 24-in. sectional signs, outdoor roof sign letters, 14-in. porcelain sign, standard panel sign, detachable letter signs, porcelain letters of various sizes and colors, flat panel sign, etc. A number of tungsten lamp fixtures are also shown and in the back of the booth is a panel board containing sockets, outlets, bushings, porch rings, steel and brass covers for outlet boxes, porcelain shades, etc., of the company's make. The display is in charge of Messrs. H. E. Brinckerhoff and W. W. Tower, assisted by Messrs. Plattow and McCurdy.

Electrical Testing Laboratories, New York, show an insulator testing plant in operation. A 250,000-volt transformer built by the Locke Insulator Company is connected in circuit with a suspension-type insulator undergoing spray tests in an enclosure. Two integrating spheres for photometric work, one 18 in. and the other 80 in. in diameter, also form parts of the exhibit. The spheres are fitted with Sharp-Millar photometers built by Foote, Pierson & Co. and are used for measuring the candle-power of arc lamps, large incandescent lamps and gas lamps. A spectacular feature is a screen on which are projected the images of three arcs, that from the ordinary carbon arc lamp, that from the magnetite arc and that from the flaming arc. The exhibit is in charge of Mr. McDonald.

The Consolidated Telegraph & Electric Subway Company, of New York, has an interesting and instructive exhibit at the left end of the main aisle. This is in charge of Mr. E. R. Quinby, assisted by Messrs. Stevenson and Seffton. A full-sized brick manhole, together with the duct connections from the manhole to the distribution box and to a standard street lamp as used in New York as well as the methods of draining the manholes, running and splicing the cables, etc., are all shown with suitable labels explaining the exhibit. A large motor-driven air compressor mounted on a truck suitable for contractors' use is shown in operation and demonstrators illustrate the use to which the air is put in air drills for rocks, etc., forming an exhibit appealing to the public and the engineer alike.

The General Electric Company features the tungsten lamp. In its well-arranged booth tungsten lamps ranging in size from 25 watts to 250 watts are displayed, some side by side with ordinary carbon filament lamps to show the relative merits of the lamp with existing lamps and some in connection with meters to show the relative power consumption of the lamps. In one corner of the section devoted to motor applications is a braiding machine for putting cotton covering on heating cord. This illustrates the process used in the General Electric factory in the covering of this class of wire. A number of direct-current wattmeters from a 6000-amp meter to small portable meters are on exhibition, together with a number of lamp inspector's meters, switchboard and portable testing instruments. Standard switchboard panels, generator panels, moving-picture machine panels, automatic compensator panels for alternating-current motors, small power panels, motor starters, rheostats, circuit-breakers, contactors, etc., are displayed to advantage. The rear half of the booth is given over to electric heating apparatus and the company's complete line is on exhibition. A new continuous type of cigar lighter for cigar stores is featured in this section. A 35-kw Curtis turbine set and two 50-hour flaming arc lamps, together with samples of tungsten miniature lamps complete the exhibit. The representatives of the company present include Messrs. F. H. Gale, T. Beran, F. W. Wilcox, W. C. Andrews, J. O. Case, W. J. Canning, W. C. Yates, S. Osborn, L. Clark, C. E. Estabrook, W. S. Brayton, A. D. Babson, F. C. Bates and Mr. Linder.

The Edward C. Cary Company, of New York.—This company's booth is in charge of Messrs. E. E. Cary, J. H. Hallberg and C. B. Kleine. The purpose of the exhibit is to show the present state of the art in dissolving stereoptics for theaters, moving picture shows, etc. The Hallberg economizers for both alternating-current and direct-current circuits are shown in connection with lanterns using Fabius Henrion carbons, the latter being especially adapted to moving-picture machine arc lamps. Two machines are shown operated on alternating-current circuits giving two projections at the back of the booth, 7½ ft. in diameter. The Hallberg economizer for alternating-current circuits is a specially constructed transformer, while the economizer for direct-current service is a combined motor-generator set changing from constant potential to constant current. The use of both devices in connection with spot lights, etc., used in theatrical work eliminates the use of dead resistance with the consequent loss.

The National Electric Lamp Company's Engineering Department occupies spaces on the main aisle facing the entrance to the arena. High-efficiency lamps are shown in profusion. Tungsten multiple lamps for operation on 1¼ to 30 and 100 to 125-volt circuits are featured. The miniature lamps are shown on the sign board and in a sample case. The arches of the booth and the ball surmounting the whole are outlined with 10-volt frosted tungsten lamps. Six-volt miniature tungstens outline the panel containing the list of companies in the association. The 25-watt, 100-125-volt lamp shown for the first time at the convention of the National Electric Light Association at Chicago is now available. The regular 40, 60 and 100-watt tungsten lamps on the side arches are shown with prismatic reflectors. The new tungsten meridian lamp in 40 and 60-watt sizes is shown pendant from the center roof arches. The side brackets contain lamps which show comparisons between the different Gem, tantalum and tungsten lamps. On the side arches are shown the several types of tantalum lamps. The 40 and 80-watt regular and meridian styles appear on the rear arches. A show case in the center of the booth contains specimens and samples of the materials from which the tungsten lamp is made. The various ores of tungsten, concentrates of these ores, metallic tungsten, tungstic acid and the several sizes of tungsten filament are on exhibition. The representatives of the association at the show are Messrs. J. C. Fish, G. G. Lockwood, S. E. Doane and A. S. Terry. The booth is in charge of Messrs. P. F. Bauder, H. S. Hall and W. H. Fisher.

Among the Other Exhibits in the gallery are automatic envelope sealers and an oscillator built by the Simplex Manufacturing Company, of New York; a number of adding machines built by the Comptograph Company, of New York; sorting and adding machines built by the Tabulating Machine Company, of Washington, D. C., and telautographs manufactured by the Gray National Telautograph Company, of New York.

Auto-Transformer Starters for Induction Motors.

Although certain induction motors, especially those having high-resistance secondary windings, may be started from rest by applying full voltage to the primary, yet this method is not desirable for use with high-efficiency squirrel-cage motors. For the latter machines use is made of single-coil transformers or auto-transformers by means of which the primary electromotive force may be suitably lowered during the starting period. In the type of motor-starting device illustrated herewith, there are two auto-transformers for each polyphase motor. For starting a two-phase motor one auto-transformer is connected to each phase, and for starting a three-phase motor the two auto-transformers are arranged in "open-delta" or V-connection.

The ends of the coils are connected to their respective line wires, and by means of the switching device the terminals of

each phase of the motor primary are connected between a line wire and a point on one of the auto-transformer coils. The motor primary then receives a percentage of the line voltage, depending on the selection of the connection points on the auto-transformer coils. If required by the starting conditions the selection of points and the switching device can be so made that the voltage is applied to the motor in several gradually increasing steps, constituting a multipoint starter; for most purposes two starting points are found to be sufficient.

The starting device shown in Fig. 1 consists of auto-transformers held in a cast-iron case and a self-contained switch

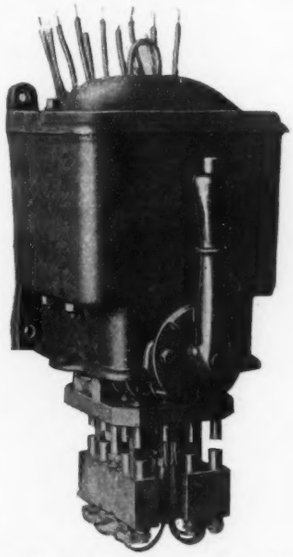


FIG. 1.—SELF-CONTAINED AUTO-TRANSFORMER MOTOR-STARTER, THE OIL-TANK BEING REMOVED.

mechanism. The switch contacts consist of copper rods abutting against brass rods, a combination of metals that has proved very satisfactory in resisting injury from arcing. The contacts are in two sets, one of which closes in the starting position and the other in the running position. In closing the switch, coiled springs around the contact rods are compressed, the total length of compression being about one-half inch. The closing of the contacts through strong compression springs insures good contact, and experience has shown that the conductivity of these contacts improves slightly with use.

The starting lever has three positions, designated as the "off," the "starting" and the "running." A locking device holds the lever securely in the off position or in the running position until released by pressing the thumb piece in the end of the

FIG. 2.—UNIT-SWITCH STARTER FOR LARGE INDUCTION MOTOR.

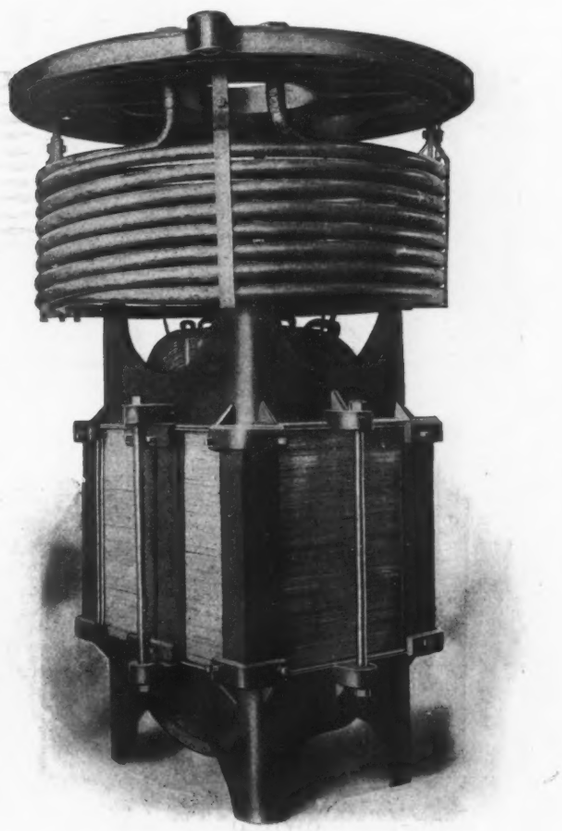
handle. The handle will not remain in the starting position unless held there by the operator, and on being released returns at once to the off position. A mechanical device prevents moving the handle directly from the off position to the running position; it must first be moved to the starting position at the extreme left, and then moved quickly back past the off position to the running position at the extreme right. If this last movement is slow the handle will be caught and held in the off position. This feature is provided in order to prevent allowing time for the motor speed to decrease while passing from the starting position, where the motor receives a fraction of the full voltage, to the running position where full voltage is applied.

These starting devices have been developed by the Westinghouse Electric & Manufacturing Company for use with its squirrel-cage type of induction motor.

500-kw Pittsburgh Transformers.

The accompanying illustration shows a 500-kw silicovanadium steel transformer built by the Pittsburgh Transformer Company, being one of a large order designed to operate at 60 cycles, 22,000 volts primary and 2200 volts secondary. The usual Pittsburgh construction has been followed in suspending the transformer and cooling coils from the cast-iron cover of the tank. The special features of this line of shell type transformers is the vertical mounting of the windings and the liberal spacing between every pair of coils.

It will be noted that the coils stand vertically, and the oil ducts, which are 5/8 in. in width, between every pair of coils induce a strong flow of oil up through all parts of the windings of the transformer, and also between the windings and the steel core. This vertical construction permits a long ventilating space, which acts like a flue to produce a circulation of the cooling medium. In these transformers it is stated the



500-KW TRANSFORMER.

flow of oil is so strong that the surface of the oil is visibly agitated, showing that cool oil is constantly flowing through all parts of the transformer.

The steel core is held rigidly and protected against movement by means of four angle irons which are set up tightly with four set screws to each angle. In order to prevent eddy currents, insulating material is placed between the angles and the core. It will also be noted that there are similar angles at the center of the core, as well as at the corners. These trans-

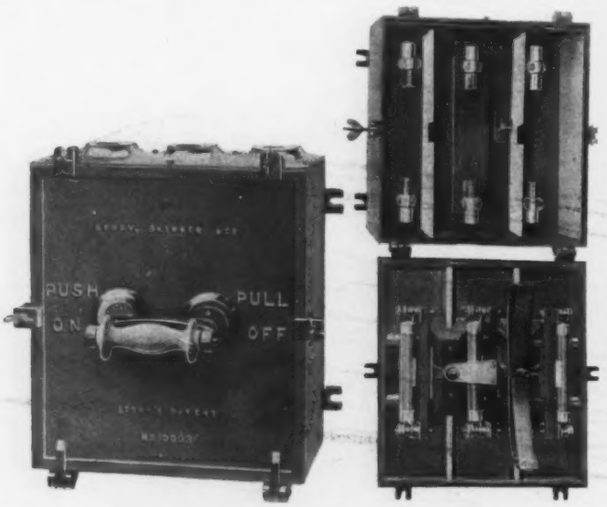
formers are ruggedly and substantially built and, owing to the complete provision for ventilation, they have a capacity for extreme overloads.

Iron-Clad Switch and Fuse Gear.

The accompanying illustrations show a switch and fuse gear that is claimed to be "fool-proof."

The switch has a "push on" and "pull off" action, the rapid make-and-break being produced by two strong flat steel springs of the carriage type. When the switch is pushed "on" the inner spring is straightened out against the action of the outer spring and after passing the dead center it flies with a rapid action into a convex position, thereby locking the switch contacts. The "break" action of the switch is a "pull off" motion. The inner bow spring changes from the convex to a concave position with a positive and rapid break.

In addition to the rapid make-and-break action, the cover is automatically locked upon closing the switch. Before a fuse can be replaced the switch must be removed to the "off" position when only parts which are removed from the live current are accessible for replacing a "blown" fuse. By a simple contrivance it is also impossible for a careless or mischievous workman to tamper with the switch blades by drawing an arc between the latter and the base contacts. The design is such that the operator himself must first close the cover before the switch contacts can be made live, and then only by reason of the "rapid make" action.



SWITCH AND FUSE GEAR.

The mechanism is dust-proof, flame-proof and watertight. The fuses are of the design and length of break in accordance with standard American practice. The apparatus has been standardized in the British Isles. It is made by Berry, Skinner & Company, London, England.

Iron-Clad Switch Mechanism.

At one time electrical engineers specified designs of high-tension switch mechanism enclosed in cells made up of horizontal and vertical slates; these designs were very satisfactory in that it was possible to trace the whole of the connections from the front, and the cellular construction rendered accidental contact with the live parts practically impossible. These designs were recognized to be good when used in connection with the small stations which were installed in those days, but at the present time the larger stations and higher e.m.fs. demand improved switchgear. The ironclad gear described below has been designed to embody the good general principles of the older types, at the same time improving upon those features which practice has outgrown.

One of the main changes in the gear has been to screen entirely all of the live conductors. To achieve this end the entire apparatus is enclosed within screens formed of iron castings so arranged that even though some parts may be entirely removed, the manipulation of the apparatus can at all times be effected without personal danger.

Fig. 1 illustrates one end of a switchboard with one of the switches withdrawn and the tank lowered for the inspection of the contacts. The switches are of the "carriage" type, and they are so combined with the stationary part of the gear that the bodily movement of the switch is followed by a pair of hinge doors, which automatically cover up the orifices on the stationary part of the gear containing the plug contacts. These doors may be locked, thereby making it impossible for a person without a key to push the switch to place again. The main features about the switch itself may be summed up under the following headings:

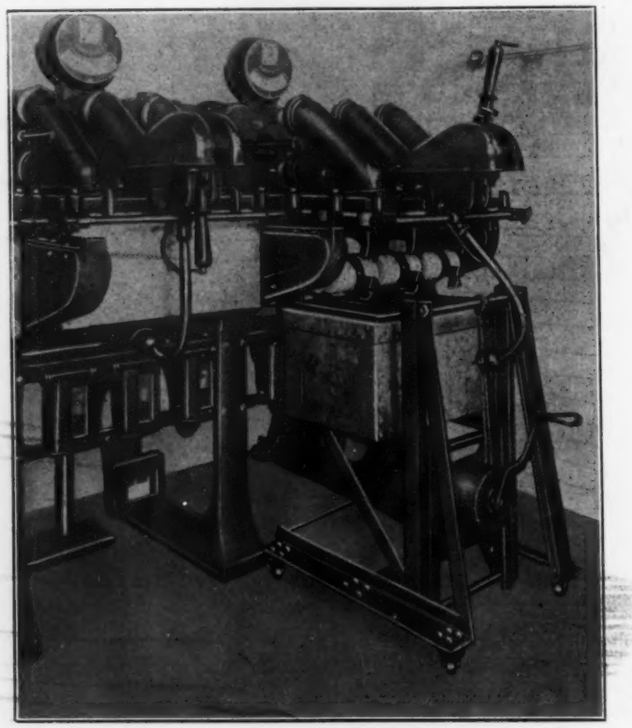


FIG. 1.—IRON-CLAD SWITCH MECHANISM.

It is the only part of the gear which can possibly require periodical inspection. When in place it is quite impossible to get access to any of the live conductors. The only way to inspect the contacts is to withdraw the complete switch carriage, thus making all the metal parts safe to handle. The switch carriage may be withdrawn by one man in a few seconds and the tank may be very quickly lowered. The switch carriage can, if necessary, be completely removed from the switchboard, leaving ample room for carrying out any work which may have to be done on the cable connections. A rack-and-lever is provided to enable the switch to be moved in or out conveniently. The racking operation cannot be done while the switch handle is in the "closed" position, and by means of interlocking the racking lever and the switch handle, it is impossible to push the switch to place while the switch is in the "closed" position; moreover, the switch cannot be withdrawn before the circuit is broken on the contacts under oil. The current-carrying parts and the insulation are of solid and heavy construction to ensure durability. The switch mechanism is constructed with a view to reducing to a minimum the time consumed by the switch in opening the circuit, and the whole of the pressure

applied by operating the handle is resisted by the main contacts under oil. A view of this contact is shown in Fig. 2. Thus, a good contact is assured and no effort applied to the handle is wasted in compressing other springs for quick release.

In the operation of the moving elements of the switch, use is made of a pair of crucible-steel wire ropes extending through a pair of curved tubes and attached at one end to a rocking

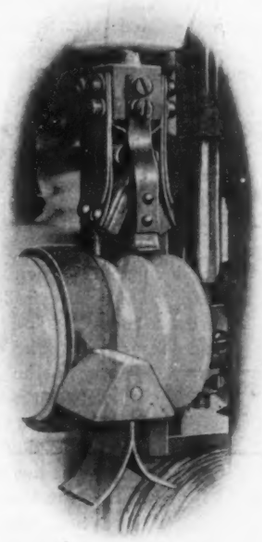


FIG. 2.—DETAIL OF MAIN CONTACT OF SWITCH.

arm, which is oscillated by an eccentrically-pivoted handle so that a pull can be exerted on the ropes. The resistance of the leverage gradually decreases until the point where the center of the rope is just above the center of the motion of the lever. In this position the lever is locked by the armature of an electromagnet. The lever can be released either electrically or it can be knocked out by operating the main switch-handle. Due to the ropes being above the dead center, immediately the lever is released the pressure applied by the springs on the contacts

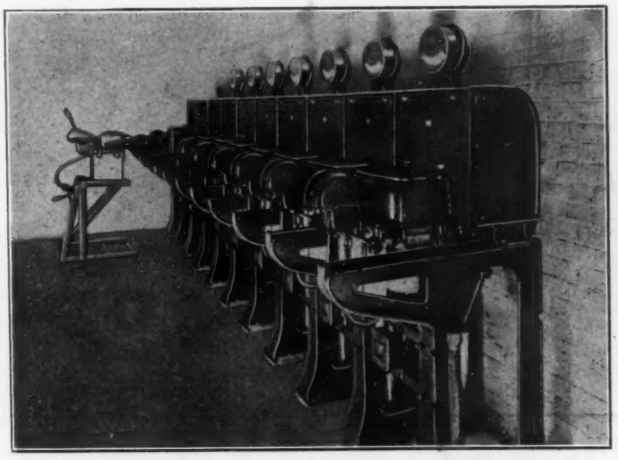


FIG. 3.—IRON-CLAD SWITCH-GEAR FOR 500-VOLT CIRCUITS.

under oil forces the contacts apart and the circuit is interrupted. The springs on the contact having given, as it were, a "kick-off," the weight of the bar carrying the movable contact ensures rapidity and a full stroke.

A pair of wings, as shown in Fig. 2, open out in order to give a slight buffering effect to avoid an excessive jarring, and at the same time they serve to stir up the oil in the neighborhood of the breaking contacts.

Reverting to the stationary part of the switchgear, it should be noted that all of the conductors are surrounded by iron castings, and these are filled in solid with insulating compound when the e.m.f. is above 6000 volts. This remark applies to the busbar chamber, the series-transformer chamber, and also to the cable dividing boxes. The castings containing these are supported upon skeleton standards bolted together in the front by straps which form supports for mounting the relays used for automatic protection.

For lower pressures the switch-gear shown in Fig. 3 is adopted. This gear embodies the same general principles as described above except that the busbars are not sealed in with compound, but are completely enclosed in order to render them inaccessible to persons operating the switches and also to avoid the risk of water or dust injuring the insulation.

The above-described ironclad gear has been developed in conjunction with the "Merz-Price" discriminating protective system, which includes the use of series transformers at each end of the apparatus protected, such as feeder cables, stationary transformers, motor-generators, rotary converters and winding of a generator or other apparatus through which electrical energy flows normally without appreciable leakage.

The respective transformers, under normal conditions, are balanced when the power at one end of the cable or other apparatus is equal to the power at the other end, but when the currents at the point of entry and exit are unequal the equilibrium is disturbed and by this means relays are operated which trip switches at both ends. Except inappreciable leakages, the current in and out of any apparatus is unequal only under a fault condition, and thus this system discriminates between an excess of operating current and a fault condition.

While the ironclad gear is specially suitable for use with the above system, it can at the same time accommodate equally well any other system of automatic protection including in-

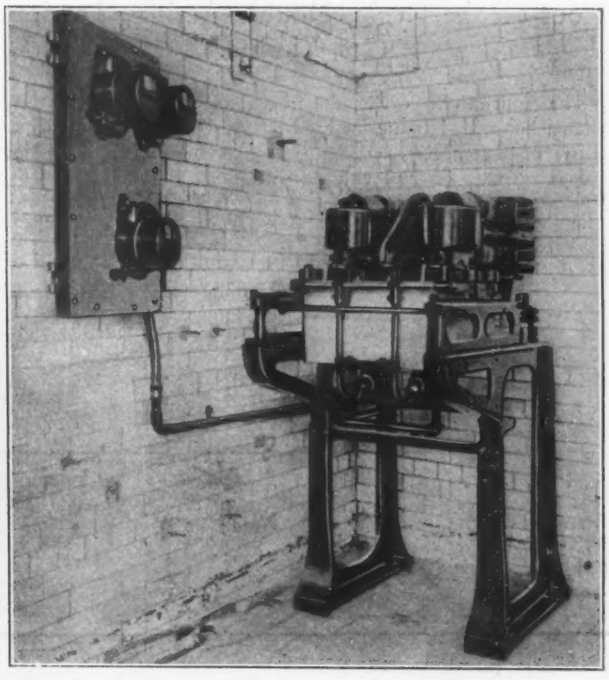


FIG. 4.—IRON-CLAD SWITCH-GEAR CONNECTED TO WATT-HOUR METER PANEL.

stantaneous overload devices, overload with time-limit, or even reverse-power relays.

Considerable importance is attached to the question of cleaning switchboards and maintaining them in such a condition that they will satisfactorily retain their insulation, and it is a general practice to clean switchboards periodically in generating and substations. This process involves great risks to the clean-

ers, as it is generally quite impossible to isolate the complete switchgear entirely. The danger is that accidental contact may be made with conductors in one panel while the cleaner is supposed to be working upon another section. There is also the danger of the cleaner assuming that the conductor is dead when all the while it may be alive for an unsuspected reason. With the ironclad gear not only are the conductors completely enclosed, but the insulators upon which the conductors are mounted are also enclosed.

In consequence of this complete enclosure there is no necessity for cleaning by hand, notwithstanding that the apparatus may be used in dusty places, and even in places which may be subject to excessive moisture. It is claimed that a jet of water from a hose pipe may be played upon the switchgear while it is alive, the gear being so constructed that the water would not gain access to any of the high-tension insulation.

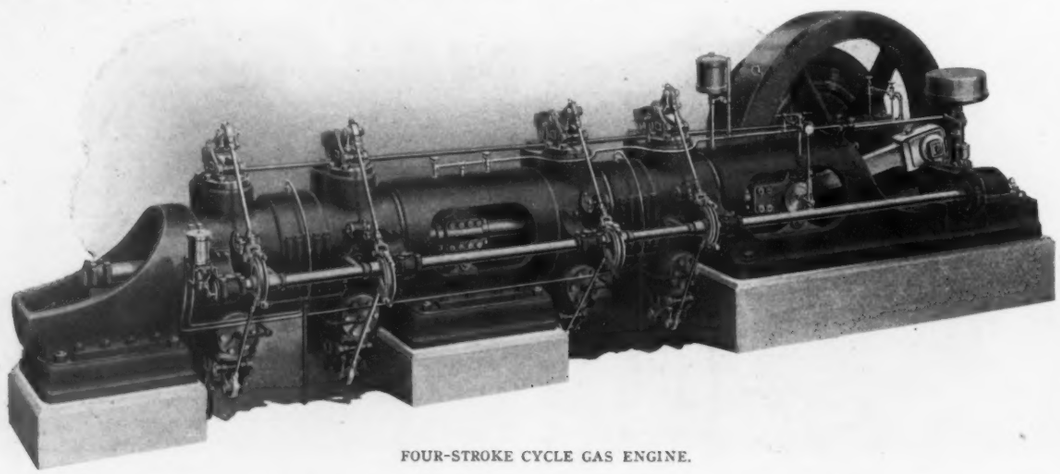
The details in the design are manufactured under patents in the name of H. W. Clothier and A. Reyrolle & Company, Ltd., of Hebburn-on-Tyne, Great Britain, who have received instructions concerning the general requirements from Mr. Chas. H. Merz and his staff, the engineers of large generating companies in the Northumberland, Durham and Cleveland districts, and they have had the exceptional opportunity of discussing in detail every point in the design with the users. Moreover, before any manufacturing on a large scale was attempted, they were enabled to fit up completely one substation and to receive the criticisms and comments of the operating engineers of the above companies, and by these valuable criticisms the manufacturers have been placed in a position to produce under very favorable circumstances the final designs embodying not only the manufacturer's own studies in the design, but also the practical experiences in the use of the gears extending over a period of two years, working upon a system with a generating plant aggregating at least 50,000 kw.

Four-Stroke Cycle, Double-Acting, Tandem Gas Engine.

The four-stroke cycle, double-acting, tandem gas engine shown herewith is manufactured by the Buckeye Engine Company, of Salem, Ohio. The engine is built with admission valves on the top and exhaust valves on the bottom of the cylinder so as to permit ready drainage of oil and other deposits directly through the exhaust valves, and also to have the valves widely separated so that the fresh charge entering the admission valve is not heated by proximity to the hot exhaust valve. The latter is of the poppet type, water-cooled internally. Each pair of admission and exhaust valves is driven by a single eccentric and effective means are provided for oiling the valve stems continuously. The eccentrics are clamped to the lay shaft and are turned spherically on the periphery, being adjusted by means of a clamped joint. The rods connecting the eccentrics and valve rockers are provided with right and left-hand threads with clamping nuts.

The lay shaft is placed on a horizontal plane passing through the center of the engine, and is driven by a set of steel gears, one of which is mounted on a drag shaft that is rotated by the main crank-pin through a universal joint. The drag shaft carries a bevel gear meshing with a pinion on the governor spindle. The governor is mounted directly on the gear box between the lay shaft and the main crank, and being driven by the drag shaft removes the usual fault found where it is driven from the lay shaft. The governor is of the high-speed type and is provided with an oil dash pot to insure stability.

The cylinder in small engines is made in one casting and in larger engines the cylinders are made in halves, bolted together in the center. The metal of the working barrel is continuous from end to end, but the water jacket has an opening entirely around the surface. This permits free expansion and contraction under the varying temperatures to which the cylinder is subjected. The opening in the water jacket is closed tight by means of a cast-iron band which is drawn tightly around the cylinder. The water space round the cylinder is ample in all directions and is so proportioned that all parts are readily accessible for cleaning and inspection. The cylinder heads are cast in one or two pieces depending on the size of the engine and are water-cooled. The joint between the cylinder and the head is made by means of a copper strip which is swaged and fitted permanently to the head. In double-acting tandem engines the water enters the rod through the intermediate crosshead, the stream divides and leaves the rod at opposite ends, draining through slots in the bed and rear end stub. Each cylinder, cylinder head, exhaust bonnet and exhaust valve is cooled and has its independent water circulation. The piston floats in the cylinder. The mixing apparatus is constructed to give a complete intermingling of the gas and air just before the supply passes into the cylinder. The operation of the mixing apparatus is as follows: With a maximum load on the engine the quality of the mixture is such as to give the highest mean effective pressure, together with a maximum amount in volume and maximum compression. When the load falls off, the mixing apparatus automatically weakens the charge by admitting less gas until the load on the engine decreases to about 25 per cent of the maximum. After this the charge is no longer weakened but remains constant in quality and varies in quantity. Throttling at very low loads is used because it is impractical under normal conditions to attain a high combustion efficiency and regular ignition with a charge sufficiently attenuated to control the speed of the engine at friction load.



FOUR-STROKE CYCLE GAS ENGINE.

The engines are designed to be operated with either the jump spark or the make-and-break spark. Double-acting engines are provided with two or more igniters in each combustion chamber and if desired can be operated with both high- and low-tension

ignition simultaneously. In the company electromagnetic make-and-break spark system of ignition, the current operates the igniter mechanism by means of an iron-clad electromagnet hammer. The circuit is periodically completed and the time of ignition controlled by a timer. The timer is provided with the following adjustments: Automatic control directly by the governor depending on the power developed during any instant; hand adjustment of all igniters simultaneously and hand adjustment of each igniter independently while the engine is running. The engines are rated to take a 10 per cent overload continuously when belted, and when direct-connected to generators to carry a continuous overload of from 15 to 25 per cent.

Electric Glue Pot for Fine Cabinet Work.

A new type of glue pot has been recently put on the market by the Simplex Electric Heating Company, Cambridge, Mass. This is called the "piano factory type" from the fact that it is designed to meet the needs of fine cabinet makers and others who use a small quantity of glue at odd times through the day The illustrations, Figs. 1 and 2, give a clear idea of the article.

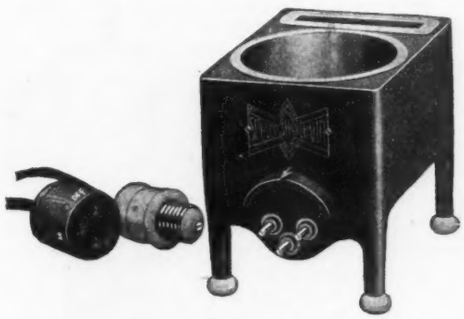


FIG. 1.—ELECTRIC GLUE POT.

The body of the pot, Fig. 1, is of iron japanned and with the electric heater attached permanently to the bottom. The glue cup, which contains half a pint, is made of spun copper without a seam and is removable for cleaning. When in place, it is immersed in the water bath contained in the iron pot. The small receptacle for hot water to keep the brushes in, is also of copper.

The larger size pot, Fig. 2, is the same in every essential respect as the smaller, but has two cups for thick and thin

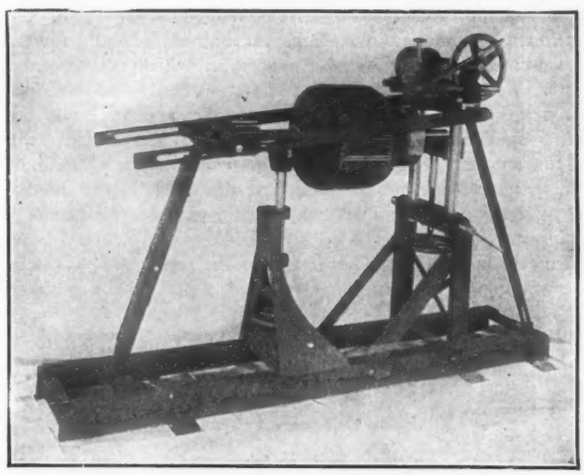
FIG. 2.—ELECTRIC GLUE POT.

glue containing one pint each, as well as a receptacle for the brushes. Each size is mounted on iron legs with procelain feet and supplied with 6 ft. of cord and a lamp socket plug. The cord is attached at the glue pot by means of another plug which gives three changes of heat, high, medium and low. These pots are very economical in the use of electrical energy and can be operated cheaply for long periods of time when the lowest heat only is used to keep the glue warm.

A Commutator Slotting Machine.

The principle of the machine shown herewith is that of the shaper, and is a highly specialized tool of that class, refined for this very delicate work. After exhaustive tests with circular milling cutter methods, it was decided that the shaper method is superior. With the milling cutter method, it is urged, it is necessary to keep an assortment of wheels of various thickness, it is impossible to cut close to the shoulder, the teeth become dull in a very short time, only a very small depth of slot can be cut, and the flying mica dust is very objectionable to the operator. These features are eliminated by this new machine, and others have been incorporated as well for speed, convenience to the operator and quality of work. The armature is very easily mounted, and the range of action of this machine is from the smallest armature used in a railway motor, for example, to the largest.

This machine, built by the Device Improvement Company, of Hanover, Pa., consists of a heavy steel bedplate, upon which are mounted the front and back heads. The back head or armature support is a heavy casting adjustable along the bed for various lengths of armatures. The armature revolves on



COMMUTATOR SLOTTING MACHINE.

this support on two brass rollers, which are adjustable vertically for various diameters. The front head of this machine acts as the support for the armature at the commutator end and also carries the cutting mechanism. It consists of two heavy standards bolted to the bed and rigidly braced. Pivoted to these standards is a heavy casting, which is locked by two heavy hand screws, and to which are bolted the heavy steel guides. The guides at the top carry the cutting mechanism proper. Between these two guides is the accurately machined V-slot, adjustable vertically, to accommodate various diameters of commutators, and in which the commutator end of the shaft is placed. The two horizontally projecting rods in the upper casting carrying the cutting head are machined absolutely true with this V-slot. These projecting rods are adjustable for various lengths of commutators. The length of the stroke is adjustable by moving the connecting-rod pivot out from the center of the gear wheel and the position of the stroke is accomplished by sliding the connecting rod in or out from this pivot. The crank gear is driven by a small pinion, which in turn is driven by tight and loose pulleys. The cutter is of ¼-in. x ¼-in. self-hardening tool steel ground to the desired shape and thickness and is held in a holder by set screws. This holder is pivoted between angle guides somewhat on the principle of the ordinary shaper, but a spring is provided for the relief of the cutter on the back stroke and its quick return

to its seat. This is bolted to a head, which is fed down by the hand wheel into the mica, and an adjustable stop is provided so that the slots may be cut a uniform depth. This front head is braced to the bed by an angle iron and the thrust of the cutting tool is further taken up by two steel straps, to which is bolted the adjustable yoke. This yoke is placed against the end of the armature shaft and locked into position on the thrust rods and also braced and supported from the rear. The front head being pivoted at the base of the guide rods can be swung back out of the way. For this reason the mounting of armatures is very easily and quickly accomplished, and, furthermore, when the armature is in position there is very little adjusting necessary before starting up.

Prepayment Ampere-Hour Meter.

A prepayment meter depending for its operation on the fundamental principle of the electrolysis of water is illustrated herewith. The instrument is marketed by the Electrical Apparatus Company, Limited, of London, England. The action of the meter is as follows: A voltmeter filled with caustic soda solution has one electrode permanently fixed to the side and the other suspended in the center. The passage of electricity electrolizes the solution and lowers its level in exact ratio to the amount of current. When the level of the solution falls below the suspended electrode, the circuit is naturally broken and the further supply of electricity is stopped until the insertion of another coin and the turning of a handle lowers and again immerses the center electrode, which is connected directly in series with the consumer's lamps. By the introduction of a third electrode into the voltmeter, a lamp inside the meter is put in series with the consumer's lamps when the paid-for amount of electricity has been consumed. The light is thus dimmed instead of being cut off entirely, the energy used in lighting the dimmed lamps being paid for by the next coin inserted. The meter is constructed to take 45 coins before requiring to be refilled. The details of the meter are shown in the engraving. The containing vessel is a plain glass cylinder

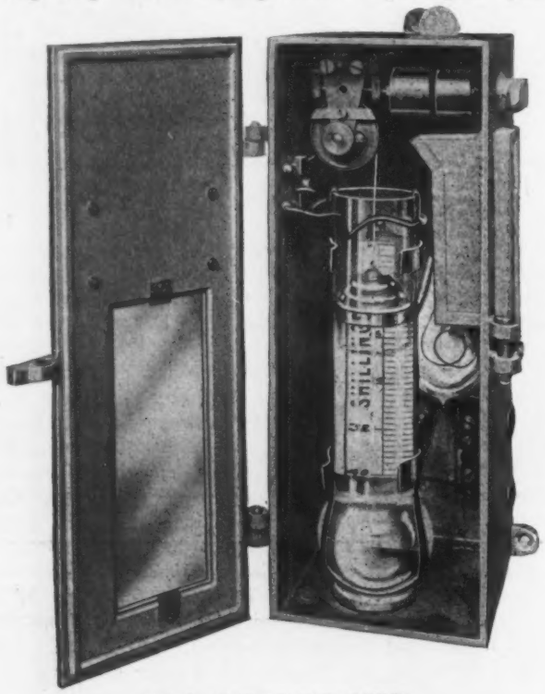


FIG. 1.—AMPERE-HOUR METER.

and two nickel strips bent over the top run to the bottom of the container, where they are kept in place by an insulator to which they are fastened. Suspended in the center by a nickel wire, which also forms a lead, is a displacer. The latter has a hole through the center terminating at the bottom in a conical hollow containing the main electrode at which the break takes place. The nickel wire passes around a drum which is connected by a simple worm gear to one-half of a slotted cylinder. The other half of the cylinder is attached to the outside handle. The insertion of the coin connects the two halves of the cylinder and allows the handle to rotate through 180 deg. The rotation of the drum lowers the displacer by a definite amount, depending on the rate, and also displaces the solution. The arrangement is shown diagrammatically in Fig. 2.

Convenient Electric Water Heater.

The lack has been long felt by druggists, hotels, cafés, dentists, and doctors of an electric water heater capable of heating a fairly large quantity of water in a very short time without the necessity of a rigid connection between the electric heater and the water pipes. This want has been supplied by the "Marvelous" electric water heater, an illustration of which is shown herewith. The glass bowl surmounting the heater is capable of holding 1 gal. of water. By means of a switch at the base of the heater, the current is turned on, not alone to the heater within the lower portion of the device which is

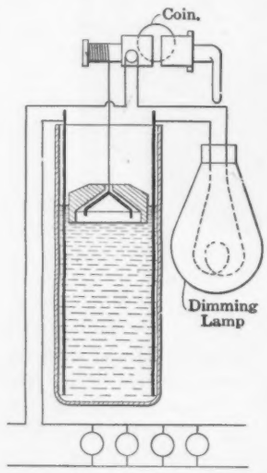
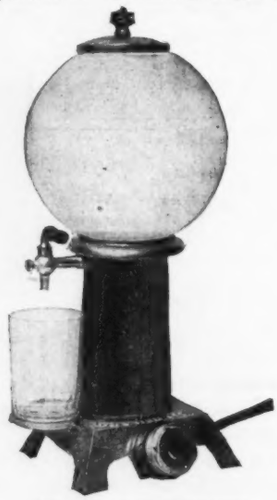


FIG. 2.—AMPERE-HOUR METER.



ELECTRIC WATER HEATER.

in the form of a tube, but also to the small lamp within the bowl, which gives visual evidence of the fact that the circuit is closed. Within 15 seconds after the current is turned on, hot water may be drawn from the faucet and within 45 seconds thereafter boiling water may be obtained. Electrical energy is used only when the heater is in operation. There is no smoke, no odor, no danger of fire and no cost for installation, as the device may be attached to a socket and can be moved to and from any place while in operation. The appliance, which is neat, ornamental and attractive in appearance, is founded on scientific principles and is of simple construction and perfect workmanship. The total height of the heater is 16 in. It is being placed on the Eastern market by the Electric Home Supply Company, 45 West Thirty-fourth Street, New York.

Copper-Clad Steel Wire.

An article in our issue for Sept. 26 descriptive of copper-clad steel wire contained an inaccuracy in that a No. 17 copper-clad steel wire was compared with a No. 12 copper wire, while the latter wire should have been compared with a No. 14 copper-clad wire to which the values given were more nearly applicable. Thus, a No. 14 copper-clad steel wire having a breaking strength of 334 lb. weighs only 60.16 lb. per mile, while a No. 12 copper wire having a breaking strength of 333 lb. weighs 104 lb. per mile. The copper-clad steel wire is made by the Duplex Metals Company, 208 Fifth Avenue, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The cooler weather throughout the country has done something to improve retail trade and therefore brighten conditions among the jobbers and wholesalers. Fall buying in heavy dry goods and clothing has been considerably larger in volume, and the active movement of crops, notably wheat and cotton, has made collections much better. Just at present there is some disposition on the part of Southern planters to hold their cotton on account of the fact that prices are much lower than last year; the gins, however, are running night and day, and the outturn is 6 per cent larger than at the same time last year. Cotton picking has gone forward rapidly this year owing to favorable weather, and up to Sept. 25, when the last government report of ginning was made, there had been 2,582,010 bales of this year's crop made ready for market. The condition report of the same date was 69.7, as against 76.1 on Aug. 25, 67.7 on Sept. 25, 1907, and 67.6, the average at this time for the past 10 years. Among the other crops conditions remain satisfactory. The smaller cereals have all been harvested, and corn is the only crop of importance that remains subject to weather conditions. The warm and dry weather has forced the corn crop toward satisfactory maturity in most sections. Light frosts in the upper part of the belt have done some damage, but not over 5 per cent of the crop has been affected. The total crop of corn may be larger than last year, but the quality is far better and the returns to the producer will be much greater. The almost unprecedentedly large movement of spring wheat, especially in the Northwest, is not only of advantage in the way of putting more money in circulation and thereby improving collections, but it is helping the railroads and reducing the number of idle cars. While the proximity of the election at present hampers business, there is no doubt that during the past week the trade movement has been better than for several months. There seems to be more tendency in commercial lines to take hold than has been in evidence heretofore, and buying is not so distinctly of the hand-to-mouth variety as it has been in most instances recently. Reports from industrial centers, too, are rather better than heretofore. The lumber industry continues to be encouraging in the South and West, and there is believed to be more building in prospect than at any other time during the present year. The iron and steel industries are particularly dull and the pig-iron market is stagnant. A few orders have been placed for cast-iron pipe, and the car-equipment companies have made some purchases of steel. Business in the other iron industries is quiet. Electrical manufacturers report some business in small apparatus. Reports to *Bradstreet's* for nine months of the present calendar year show 10,691 failures, with $244,835,494 of liabilities, an increase of 55 per cent in the number and of 110 per cent in the liabilities, as compared with the first nine months of 1907. Only in the year 1893 have the liabilities been greater. Failures for the week ended Oct. 1 were 225, against 267 last week, 177 in the corresponding week of 1907, 136 in 1906, 189 in 1905, and 195 in 1904.

THE COPPER MARKET.

There has been very little demand for copper during the past week either by consumers or dealers, and but few sales have been recorded. Prices, however, have held steady in spite of the absence of demand, and holders, so far as has been recorded, have made no concessions to secure sales. This strength in tone in the market, in the face of strikingly adverse statistics, emphasizes the fact that the present controllers of the market are thoroughly confident of their ability to prevent any demoralization and maintain prices at any reasonable figure. These interests are financially able to hold the actual metal until the demand returns. In the meantime statistics are constantly opposed to price stability. While it is confidently believed that the large consumers must soon come into the market, the accumulation in this country is still rapidly increasing. During September the domestic production was about the same as that during August, which was between 70,000,000 and 80,000,000 lb. and the consumption was supposed to be about 35,000,000 lb. The exports were lighter than in August, being something less than 45,000,000 lb., thus practically equaling the surplus home production. To this amount, however, must be added the unusually large imports, which were probably greater than in any other month during the year, being between 10,000 and 12,000 tons. According to the Government reports there was an accumulation of 135,000,000 lb. of copper in this country at the beginning of the year. Accepting the statements of the metal selling agencies that during the year up to Sept. 1 domestic consumption and exports have about equaled production and imports, it seems that with the September accumulation added to the January figures there are now stocks in this country of something like 160,000,000 lb. It is known that the surplus stocks in Europe are exceedingly heavy—some statisticians figuring them to be in excess of 200,000,000 lb. In spite of these figures, which are furnished by the producers themselves, many sellers claim that American stocks are small and will be absorbed easily when the big melters begin to buy. During the first nine months of the year the foreign buyers have been the salvation of the American producers. It is figured that in this period 222,000,000 lb. more have been sent abroad than in the same period in 1907. The exports for the month up to Oct. 5 were 1,513 tons. Prices on the Metal Exchange on that date were:

Lake	13⅜	@	13⅝
Electrolytic	13⅛	@	13⅜
Castings	12⅞	@	13⅛

The London market was as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	59	12	6	59	13	9
Standard copper, futures	60	10	0	60	10	0
Market	Steady.			Quiet.		
Sales of spot				350 tons		
Sales of futures				400 tons		

Extreme fluctuations for the year:

	Highest.			Lowest.		
Electrolytic copper, spot	13¾			12¼		
Lake copper, spot	13⅞			12⅜		
Casting copper, spot	13½			12⅛		
London, spot	£64	5	0	£56	5	0
London, futures	64	10	0	56	17	6
London, best selected	67	10	0	60	0	0

WESTERN ELECTRIC COMPANY DOES GOOD BUSINESS.—It is stated by an official of the Western Electric Company that the gross sales of the Western Electric Company are running at the present time at a rate somewhat better than $30,000,000 per year. This compares with a low rate during the depressed times of $22,000,000. The indications are that the gross sales for the fiscal year of the company, which ends Nov. 30, will be about $27,000,000, which compares with $52,724,168 in 1907 and $69,000,000 in 1906, the banner year of the company. In spite of the large decrease in earnings, it is expected that the company will just about be able to earn its usual 8 per cent dividend on the year's business. This will be made possible by careful curtailment of operating expenses. The copper consumption of the company during the year has been small, being about 15,000,000 lb. In 1906 the copper consumption was 65,000,000 lb. The company has just purchased 40 acres at Twenty-sixth Street and South Forty-eighth Avenue, Chicago, where it will build a large addition to its present plant.

NEW CONCERN TO MANUFACTURE LAMPS.—The American Electrical Manufacturing Company has just been incorporated under the laws of New Jersey, with capital stock of $350,000, to engage in the manufacture of all classes of standard lamps, as well as dry batteries and several other electrical specialties. The company expects to be in operation about Jan. 1, with a capacity of 5000 lamps a day. The prime mover of the new enterprise is Mr. T. Wesley Wright, who is well known in his connection with the Hill-Wright Electric Company, and who promises some novel and interesting propositions for lamp buyers. The company's plant will be located at Orange, N. J., and its New York office will be at 105 Reade Street.

MEXICAN PLANT BUYS GERMAN APPARATUS.—An order for electrical machinery to the amount of $3,750,000 gold has just been placed by Manuel Cuesta Gallardo, of Guadalajara, Mex., with a German manufacturing concern, for the proposed irrigation project in the state of Jalisco, adjacent to Lake Chapala from which the water supply for the purpose will be obtained. The electric plant will provide the power for operating the irrigation pumps. The plans, which have already been prepared and received the sanction of the Federal government authorities, call for the development of about 70,000 hp by means of hydro-electric plants. The larger of these plants will be situated in the canyon of the Santiago River, a short distance from Guadalajara. The water will be diverted from the river by means of a canal and a fall of about 1,400 ft. obtained. This waterfall will be capable of generating about 60,000 hp. The other hydro-electric plant will also be located upon the Santiago River, 15 miles from Guadalajara. It will have a capacity of about 9,000 hp. Three irrigation pumping stations will be installed—one at Ocotlan, another at Pencitlan and another at Zula. It is planned to install four more pumping stations later on. In addition to providing power for these pumping plants, transmission lines will be built to the city of Aguas Calientes, 200 miles distant; to Guadalajara and to Etzatlan and other mining districts, situated in remote parts of the state.

SOUTH AMERICAN TROLLEYS.—Vice-Consul John R. Silliman, of Saltillo, Mexico, states that, according to an official publication of recent date, a concession for the construction of an electric street railway in that city has been granted to Messrs. Schondube & Neugebauer and Engineer Rodolfo M. Garza. According to the concession, the plans must be approved and work begun within nine months. An American consular officer in Latin America reports that an electric line is to be built in the country in question. The line will be about 50 kilometers in length and will cost about $500,000. The surveys have already been completed, and it is believed that the line will conduct a freight as well as a passenger business.

PRICE OF TUNGSTEN LAMPS.—The beauty and glitter of the tungsten lamps at the Madison Square Garden electrical show is a universal theme of conversation among electrical people. The lamp is one of the great features of a fine display. There is a most persistent rumor afloat, but not confirmed, that another great reduction in price is at hand, and will amount to not less than 33 1/3 per cent. If this is true, it is a reminder of the way in which the carbon filament lamps in the early days came down from the heights of one dollar, with sweep reductions. It is even said that this cut may date from October 1.

MUNICIPAL TRACTION COMPANY SUED FOR RENTAL.—The Cleveland Railway Company has brought suit against the Municipal Traction Company, which is operating its lines on a low fare basis, for $220,134 for rental due to Oct. 1. The rental was tendered by the Municipal Company, with the stipulation that the money be used in paying 1½ per cent quarterly dividends to the Cleveland Railway Company's stockholders. This the officials refused to do, saying outstanding debts must be paid before dividends.

WIRE IN JAPAN.—According to a consular report, a Japanese copper mining company contemplates the building of a factory for the manufacture of wire for electrical use and has made an offer to a Gokohama wire works to take up half of the capital of the latter and conduct the concern under joint management. Last year copper conductors for electrical purposes were imported into Japan to the value of $1,231,354, while copper in ingots was imported in large quantities.

LIGHTING PLANT FOR EGYPT.—The Ministry of the Interior, Cairo, Egypt, will receive bids until Oct. 29 for the necessary equipment for the installation of electric light in the town of Zagazig. A guarantee equal to 10 per cent of the amount of the bid will be required.

EXPORTS TO GERMANY.—The exports of electrical appliances from the United States to Germany during the seven months ending with July were $53,479 this year as compared with $227,999 last year. The exports of electrical machinery were $63,451 as compared with $61,758.

APPARATUS FOR CHILI.—Bids will be received until Nov. 2 by the Direccion General de los Ferrocarriles del Estado, San Eugenio, Chili, for the supply of three 300-kw generators and other equipment.

WINNFIELD, ALA., MUNICIPAL PLANT.—Mr. H. W. Wright has been appointed superintendent of construction of the electric light and water-works plant to be erected by the city of Winnfield, Ala.

Financial Intelligence.

THE WEEK IN WALL STREET.

The course of the stock market in Wall Street during the past week has been generally upward, and the tone has been buoyant. For the week which ended Oct. 5 the net changes were almost universally gains, and in some instances they amounted to substantial improvement. The trading during the first few days of the week, however, was very limited, and throughout the whole week it was confined principally to a few specially favored issues. The Harriman stocks were strong because they have been supported with especial zeal by the interests which have been behind the upward movement since last spring. There were reasons that are easily explainable for changes in certain stocks. American Can preferred is being handled by a pool which put up the price eight points; the August report of Union Pacific made easy the boosting of the common stock of that road; the assurance that no trouble would be met in financing the $7,100,000 notes of the St. Louis & San Francisco road, due Dec. 1, relieved the Rock Island, the parent company, and advanced its stocks. On the other hand, the reduction of the dividend on International Paper, caused a sharp decline, and Manhattan traction securities were depressed. The public is not trading in the market, and there appears to be little likelihood that it will do so until after the election. This fact can scarcely be attributed to a lack of confidence either in the outcome of the election or in the future of Wall Street prices, but is to be credited to that conservatism which has marked all business since the period of depression began. As a matter of fact, there is a hopeful sentiment among those who frequent Wall Street and talk regarding the evidence of coming prosperity. There is wealth in the farming sections, greater than ever known before, thus making the buying capacity of the country all that could be desired. Manufacturers are beginning to report improvement, indicating that the worst has passed and promising that soon all the idle will be able to find employment. The number of idle cars has been steadily reduced since midsummer, until now only 8 per cent of all the railroad equipment is unemployed. Bank clearings are well maintained, and while they are still far below 1907, they are well up to the average of previous years. The balance of trade with foreign countries continues to be largely in our favor, even with greatly reduced exports of manufactured articles. The tremendous reduction in imports has been more than an offset to export decline, and has also been another evidence of the conservatism of the American

NEW YORK.

	Sept. 28.	Oct. 5.	Shares Sold.		Sept. 28.	Oct. 5.	Shares Sold.
All.-Ch.	10¼	10¾	500	Int.-Met., pfd.	32	31¾	5,855
All.-Ch., pfd.	31⅜	32¾	6,900	Mackay Cos.	68	68¾	600
Amal. Cop.	73	75	74,660	Mackay Cos., pfd.	68*	68⅜	100
Am. D. T.	35*	35*	——	Manhattan Elev.	136	137	100
Am. Loc.	46¾	46¼	7,470	Met. St. Ry.	30*	25*	500
Am. Loc., pfd.	101⅛	104	439	N.Y.&N.J. Tel.	116	116*	——
Am. Tel. & Cbl.	70*	70*	——	Steel, com.	44⅜	45¼	202,600
Am. T. & T.	129	127⅞	11,200	Steel, pfd.	108⅛	108½	11,400
B. R. T.	47¼	49¼	20,670	W. U. T.	61⅛	60	1,350
Gen. Elec.	139	142	1,350	West'h, com.	74	74	9,710
Int.-Met., com.	10⅞	10¾	7,850	West'h, pfd.	88	88*	——

PHILADELPHIA.

	Sept. 28.	Oct. 5.	Shares Sold.		Sept. 28.	Oct. 5.	Shares Sold.
Am. Rys.	44¾	44¾	——	Phila. Elec.	9¾	10¼	——
Elec. Co. of A.	9⅞	10	——	Phila. R. T.	19¾	20½	——
Elec. Stor. B'ty	35½	36	——	Phila. Traction.	88	88¼	——
E. S. B'ty, pfd.	49*	49*	——				

CHICAGO.

	Sept. 28.	Oct. 5.	Shares Sold.		Sept. 28.	Oct. 5.	Shares Sold.
Chi. City Ry.	176½*	176½*	——	Met. El., com.	13¼*	13¼	——
Com. Edison	106¼	106	——	Nat'nal Carbon.	70*	69	——
Chi. Subway	19	19*	——	Nat. Carb., pfd.	108	108*	——
Chi. Tel. Co.	146	123	——				

BOSTON.

	Sept. 28.	Oct. 5.	Shares Sold.		Sept. 28.	Oct. 5.	Shares Sold.
Am. Tel. & Tel.	129	128	——	Mass. E. R., pfd.	52	52	——
Com'bind Tel.	125*	125*	——	Mex. Tel., pfd.	6	6	——
Gen. Elec.	139	141	——	N. E. Tel'p.	119¾	120	——
Edison El. Ill.	230*	230	——	W. Tel. & Tel.	8	8*	——
Mass. Elec. Ry.	10¼	10¼*	——	W. T. & T., pfd.	80	80*	——

*Last price quoted.
Shares sold are for week Sept. 28 to Oct. 3.

public in times of stress. One of the strong features of the stock market during the week, and, in fact, during the last two months, has been the strength of American shares in London. There has been a good, steady buying at all times of the best dividend-paying securities, and in times of price reaction, such as occurred a few weeks ago, there is almost a bargain counter rush for the most substantial issues. On Oct. 5, the last day under review, the market was strong and inclined to be active. Almost a million shares were sold, and most of the active issues recorded advances. The money market has been a trifle stronger and the demand somewhat improved. Call money Oct 5 was quoted at 1@1½ per cent and 90-day loans at 3 per cent. The quotations in the table are for the close, Oct. 5.

DIVIDENDS.

Cincinnati, Newport & Covington Light & Traction Company, preferred, quarterly, 1⅛ per cent; common, ⅞ per cent, payable Oct. 15.

United Metals Selling Company, quarterly, 5 per cent, payable Oct. 15.

Mexican Light & Power Company (Montreal), common, quarterly, 1 per cent, payable Oct. 15.

Standard Underground Cable Company, Pittsburg, quarterly, 3 per cent, payable Oct. 10.

Shawinigan Water & Power Company, quarterly, 1 per cent, payable Oct. 15.

Brooklyn City Railroad Company, quarterly, 2½ per cent, payable Oct. 15.

WESTINGHOUSE PLAN FINALLY ADOPTED.

The readjustment committee of the Westinghouse Electric & Manufacturing Company has accepted the plan proposed by the merchandise creditors. The committee announced that it accepted a "modified or substitute plan" for the readjustment of the debt. As a matter of fact, the plan accepted is practically the original merchandise creditors' plan, and it is now offered as the solution of the Westinghouse troubles. The new plan provides as follows:

"First—Holders of convertible bonds, debenture certificates and collateral notes who have already deposited their obligations with a depositary of the readjustment committee need take no further action.

"Second—Such of these holders who have not deposited their obligations should deposit them with one of the depositaries of the readjustment committee.

"Third—Holders of merchandise claims who have deposited an assignment of their claims with a depositary of the readjustment committee and executed an agreement with the merchandise creditors' committee to take stock in payment of their claims, need take no further action, but creditors who have deposited their claims and who have not executed an agreement with the merchandise creditors' committee should sign such agreement and forward the same to George M. Verity, secretary, 165 Broadway, New York.

"Fourth—Holders of merchandise claims who have not deposited assignments of their claims should execute an agreement to the merchandise creditors' committee and forward the same to the secretary.

"Fifth—Holders of notes payable, 'bank debt,' who have deposited their notes with one of the depositaries and executed an agreement to take securities in accordance with the creditors' plan need take no further action. Those who have not deposited their notes and who have executed an agreement to take securities should deposit their notes duly endorsed without recourse with one of the depositaries.

"Sixth—Holders of notes payable, 'bank debt,' who have not deposited their notes or executed an agreement to take securities should at once deposit their notes and execute an agreement in the form provided by the readjustment committee in which should be specified the securities which the holder elects to take in compliance with this modified or substitute plan."

This means that the bonded indebtedness of the company, $18,500,000 of 5 per cent gold bonds and $1,969,000 notes due July 1, 1912, will be disturbed. The merchandise debt of $4,762,560 is to be taken up by assenting stock at par and the bank debt of $7,919,000 is to be liquidated by the options allowed under the plan. In any case one-half of this amount is to be taken in debenture bonds of the current issue.

The other half may be taken either in 5 per cent notes of the company in three equal amounts, maturing respectively in four, five and six years from their date, to the extent of 30 per cent of the face value of the claim and for the balance of the claim assenting stock at par, the creditor to have the privilege, however, of taking a larger amount in assenting stock and a lesser amount in obligations; or at the option of the creditor in respect of the one-half of the claim not covered by convertible bonds, 5 per cent notes of the company maturing 15 years from their date.

With the acceptance of this plan the future management of the company is placed in the hands of a board of directors of 12 members, who, in the first instance, will be approved by the readjustment committee and must be acceptable to the merchandise creditors' committee. The subscriptions of the stockholders and the bank debt holders must be received in sufficient volume by Oct. 27 to satisfy the readjustment committee, in order to make the plan operative.

In connection with this report, Mr. George Westinghouse has issued a letter to the stockholders urging the delinquents to send in their subscriptions, in which he says:

"Those stockholders (about 1800 in number) who have not yet made their subscriptions to their pro rata amount of the assenting stock necessary to place your company upon a firm basis, are indebted for the progress made toward the preservation of their interest in the company to the merchandise creditors, who have signed agreements to take over $4,000,000 of assenting capital stock at par value for their claims against the company, and to the prompt action of 2200 other stockholders who, in a period of great financial stress, and when the market value of assenting stock was less than 50 per cent of par, subscribed at par their pro rata amounts of new assenting stock (viz., one share for each four shares) required to be taken by all stockholders to make effective the merchandise creditors' plan, of which you have been fully informed and which has now been formally adopted as the only plan of the readjustment committee.

"In addition to the subscriptions so far made by stockholders, and of greater importance in many respects, in the efforts to prevent the winding up of the company, over 5000 employees and others located near your works, who are interested in the continuation of your business, have also subscribed for 12,225 shares at par.

"The business of your company under the receivers has been efficiently managed and advantage has been taken of the opportunity occasioned by the general depression in trade to effect most desirable changes in manufacturing methods, which will be of lasting benefit in the future operations of your company. The general organization has at the same time been so maintained on a conservative basis that immediate advantage can be taken of an increase in business.

"The greatly improved condition of your affairs here and in Europe, with the excellent prospects for a prosperous business when general commercial conditions again become normal, have caused some of the most important banks, which hold notes of the company, to sign agreements to take for their notes one-half in convertible bonds and one-half in assenting stock at par, and other banks have agreed to the precise arrangement proposed by the readjustment committee in its circular of July 1, viz., one-half in bonds, 30 per cent in four, five and six-year notes, and 20 per cent in assenting stock at par, with an option to elect to take half bonds and half stock.

"There is enclosed a statement prepared by the auditor of the company, which shows how greatly the company would be strengthened by the immediate completion of the plan, and especially by the elimination of the proposed four, five and six-year notes. The statement also shows that assenting stock, taken at par, should be a safe investment. None of the stock taken by noteholders can be counted as part of the $6,000,000 cash subscriptions required from stockholders, but is to be issued in lieu of the proposed four, five and six-year notes.

"It is the desire and will be the effort of the merchandise creditors' committee, of the officials of the company, and of the stockholders' committee to aid in securing from noteholders, in liquidation of their claims, an agreement to accept at least 50 per cent in assenting stock, and to this end there can be no greater help than your immediate subscription of one share for each four you now own, whether in your own name or still in the name of a former owner.

"I have subordinated my own interests in order to save a valuable property to the stockholders, and I am willing to

make further sacrifices; but to effect a complete and satisfactory rehabilitation of your company requires your cordial support and prompt material assistance, and, therefore, whether you have (as some stockholders have informed me they would do) awaited the formal adoption of the merchandise creditors' plan by the readjustment committee, or whatever may have been your reason for not heretofore subscribing for your pro rata amount, you are earnestly urged to at once sign the enclosed subscription form and make your remittance, so that the company can be promptly taken from the hands of the receivers, thereby favorably affecting, at a critical time, the general business affairs of the country, as well as your own holdings."

The statement to which reference is made in the letter of Mr. Westinghouse shows the estimated resources and requirements of the company for five years, starting April 1, 1908. The estimated resources are, minimum, $38,190,920; probable, $54,090,920. Both of these estimates figure the entire $6,000,000 assenting stock to be taken by stockholders. The requirements of the company, including 6 per cent dividends on the assenting stock, if the bank creditors take 20 per cent in stock, are estimated to be $33,811,700, and $31,579,785 if they take 50 per cent in stock.

It is stated in Pittsburg that in the event of the stockholders failing to take the $1,500,000 assenting stock yet unsubscribed before Oct. 27, that arrangements have been made by Mr. Westinghouse to personally care for the shortage.

BONDS FOR WESTERN ELECTRIC MINORITY STOCK.—While it has not yet been definitely decided, it is probable that the American Telephone & Telegraph Company will pay for the $3,000,000 minority stock of the Western Electric Company, upon which it has an option expiring Oct. 15, in 4 per cent convertible bonds instead of in cash. Up to last December the Telephone Company owned $9,012,000, or 60.08 per cent of the $15,000,000 stock of the Western Electric Company, and at that time it made an offer to purchase the balance. About half of the minority holders have accepted the offer. According to its offer, the telephone company reserved the right to pay for this stock either in cash at $225 per share or in 4 per cent convertibles at the rate of $250 per share of Western Electric. The Telephone Company has an authorized issue of $150,000,000 4 per cent convertible bonds, of which $100,000,000 are issued and outstanding. The remaining $50,000,000 are still under option to the banking syndicate which underwrote the first lot and this option does not formally expire until Oct. 1, so that it will be after Oct. 1 before the company secures the release of these bonds for treasury purposes. The minority stockholders of the Western Electric Company, if paid in 4 per cent convertible bonds, can figure on a profit above the offering price, which was 90, as the bonds have been above that figure for some time.

ALLIS-CHALMERS COMPANY HAS GOOD YEAR.—The annual report of the Allis-Chalmers company, which has just been made public, shows that the operating profits of the company for the year ended June 30, 1908, were $2,573,961, or more than double those of the previous year, which were $1,226,242. The charge for maintenance, depreciation, etc., was $1,958,147, as compared with $1,613,540 in 1907. At the same time there was a surplus for the year of $385,817 after providing for last year's deficit of $229,817. In his remarks to stockholders President W. H. Whiteside says: "Noteworthy success has been obtained in the sale and operation of our new lines of production, namely, gas engines, steam turbines, hydraulic turbines and electrical apparatus which are now among the standard products of our company. The extended use of these lines of production, often in connection with our older products, not only by purchasers who have long been our regular customers, but by numerous new customers in almost all classes of industry, forms the basis for an increasing and profitable business."

WESTERN UNION TELEGRAPH COMPANY.—Stockholders of the Western Union Telegraph Company have received an estimated statement of the earnings for the quarter ended Sept. 30, which shows that the business of the company has recovered steadily from the depression. The estimated net earnings for the quarter are $1,700,000, which, after paying the fixed charges and the ½ per cent dividend on the stock, would leave a surplus of $768,447. Added to the present surplus, this sum would make a total of $15,163,004. That the company is rapidly getting back to its former earning basis is shown by comparing these figures with those for the same quarter in 1906 (a comparison for the similar quarter of 1907, the year of the strike, would be worthless). During that quarter the net earnings were $1,660,519. At that time the company was paying 5 per cent dividends.

MASSACHUSETTS ELECTRIC COMPANIES.—Gross earnings of the Massachusetts Electric Companies for the fiscal year ended Sept. 30 show a slight increase over the previous year, but the net earnings are about the same. The company now has a floating debt of about $4,000,000. The issue of $1,500,000 of preferred stock, which it is desired to put out, would enable the operating companies to reduce their obligations to a figure which it is thought would not prevent the resumption of dividends by the holding company.

BOSTON ELEVATED RAILWAY COMPANY.—Gross earnings of the Boston Elevated Railway Company for the fiscal year, which ended Sept. 30, show the smallest increase of any 12 months since the company began operations. Total gross earnings for the year were $13,625,000, a little more than $75,000, or 0.6 per cent increase. It is probable that the earnings of the year would have shown a decrease except for a gain in September. In September, 1907, the weather was particularly inclement in Boston and traffic was light.

MISSOURI ELECTRIC RAILROAD BONDS.—The Missouri Electric Railroad, which has acquired the property of the St. Charles & Western Railway, has filed a mortgage covering an issue of $1,000,000 of 5 per cent bonds. The mortgage is to the Mercantile Trust Company, of St. Louis, as trustee. The Missouri Electric road is a subsidiary company of the United Railways Company of St. Louis.

GENERAL RAILWAY SIGNAL PASSES DIVIDEND.—The directors of the General Railway Signal Company, of Rochester, N. Y., have decided to pass the regular quarterly dividend of 1½ per cent on the $2,000,000 of 6 per cent cumulative preferred stock. The company has paid these dividends regularly since its organization in 1904.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Norfolk (Va.) & Portsmouth Traction Company:					
August, 1908	$147,872	$94,575	$80,297	.....	.....
August, 1907	307,488	171,544	135,944	.....	.....
Knoxville (Tenn.) Railway & Light Company:					
August, 1908	49,246	25,641	23,604	$11,483	$12,121
August, 1907	54,856	29,248	25,607	10,625	14,982
Little Rock (Ark.) Railway & Electric Company:					
August, 1908	56,868	28,851	28,017	11,315	16,701
August, 1907	54,652	27,321	27,321	8,362	18,968
Lexington (Ky.) Interurban Railway Company:					
August, 1908	63,246	35,844	27,402	.....	.....
August, 1907	59,085	32,917	26,168	.....	.....
Interborough Rapid Transit Company:					
Year ended June 30, 1908	24,059,299	10,722,694	13,336,605	10,856,116	3,700,659
Year ended June 30, 1907	22,363,802	9,593,331	12,770,471	9,869,859	3,716,444
Detroit United Railway Company:					
August, 1908	691,489	443,939	247,550	134,859	117,648
August, 1907	727,912	427,767	300,145	133,112	171,168

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—The city is making arrangements to place its fire alarm wires in underground conduits.

UNIVERSITY, ALA.—Bids will be received at the office of John W. Abercrombie, president of University of Alabama, until Oct. 24 for furnishing engineering laboratory and power plant equipment for engineering building, also for furnishing material and constructing a central heating system.

JUNEAU, ALASKA.—The managers of the Treadwell Mine are experimenting on an electrical process for treating the concentrate at the mine. It is proposed to use oil-engine power to generate electricity in winter and water in summer.

ARGENTA, ARK.—Arrangements are being made for increasing the output of the municipal electric light plant, which will include the installation of a 250-hp tandem compound Ide engine, a 150-kw direct connected generator; also a motor-generator set and a five-panel switchboard. The plant when completed will furnish electrical energy for operating the street railway system. Orders have been placed for the equipment. George F. Brockman has charge of the work.

BERKELEY, CAL.—With the completion of the new substation above North Berkeley the high-tension transmission lines of the Bay Counties Power Company will be taken down and electricity will be distributed direct from the new plant, which will be completed the latter part of November, at a cost of about $115,000.

BIG PINE, CAL.—Charles D. Lane, Jr., announces that a San Francisco syndicate, which he represents, has taken up rights on Roher Creek, and that work will commence shortly on the installation of an electric power plant. The company proposes to develop 1200 hp. The property was purchased of Napoleon Baker, of Big Pine. Besides the power rights on this creek, the company has been given a site for its plant in Baker Canyon.

CALISTOGA, CAL.—E. D. Lehe, of Dixon, has applied to the Board of Supervisors for a franchise to erect transmission lines over the roads in Napa County from this city to the Lake County line, passing through St. Helena and Calistoga. Mr. Lehe proposes to re-establish the electric lighting system of the Napa Valley Power Company, which was put out of commission through the failure of the Bank of Calistoga. He also proposes to furnish electricity to farmers for irrigation purposes, etc.

HANFORD, CAL.—Surveys have been completed for the Fresno, Hanford & Summit Lake Interurban Railway, and it is expected that work on the construction of the system will begin about Nov. 1. The railway will extend from Fresno to Hanford, a distance of about 40 miles. The overhead trolley system will be used, and it is planned to build the main power plant at Kingsbury, with substations at Malaga and Laton. The company proposes to establish two amusement resorts, one to be located at Laton, and the other on Kings River, about three miles east of Laton. The company is capitalized at $1,000,000, and the officers are: L. A. Nares, of Fresno, Cal., president; F. S. Granger, of Hanford, Cal., vice-president and general manager; J. D. Biddle, of Hanford, Cal., secretary; H. A. Beckhuis, of Hanford, treasurer. Chadwick & Sykes, of San Francisco, are chief engineers.

KENNETT, CAL.—The Northern California Power Company is erecting its high-tension transmission line from its power plant to the substation in Kennett, which is to be the distributing center for the entire copper belt. The new line will transmit electricity at 60,000 volts.

MODESTO, CAL.—The Board of Supervisors has granted the Sylvan Telephone Company permission to erect telephone lines over certain roads in the county.

SACRAMENTO, CAL.—Work has commenced on the construction of the new dam for the Folsom Water Power Company on South Silver Creek in El Dorado County. It is expected that the new plant will give the company 10,000 additional horse-power, which will be used in Sacramento. It is expected that the plant will be installed within a few months.

SAN FRANCISCO, CAL.—It is reported that the United Railroads Investment Companies has purchased control of the Stanislaus Power Company.

SOLDIERS' HOME, LOS ANGELES COUNTY, CAL.—Bids will be received at the office of the treasurer of the Pacific Branch, N. H. D. V. S., Soldiers' Home, Los Angeles County, Cal., until Oct. 16 for furnishing electric motor for laundry, for furnishing and installing dynamo in power house and for removal of steam heater and main hot water and return pipes, in accordance with plans and specifications, copies of which, with blank proposals, can be obtained upon application to E. W. Moore, treasurer.

DILLON, COL.—The power plant of the Summit County Power Company will soon be completed and placed in operation. The plant will supply electricity in Montezuma, Argentine, Frisco, Breckenridge and French Gulch. W. C. Sterne is vice-president and general manager.

MANCOS, COL.—The Montezuma County Telephone Company has purchased the property and holdings of the Montezuma Telephone Company. The new company was formed to take over the property of the old company and to extend the system over the county generally. It is proposed to install an exchange at Cortez and to provide telephone service in both Cortez and Dolores and intervening towns, and also give long-distance service over the entire state. The officers of the new company are: P. T. Guillet, president; H. Bingham, secretary, both of Cortez, and S. W. Carpenter, of Mancos, manager.

NORWICH, CONN.—The annual report of the Gas and Electric Light Commissioners shows a profit of $26,986, for the year ending July 31. The net earnings above the cost of the production was $41,286; from this was deducted 5 per cent for depreciation, which amounted to $14,250 for this year. The commissioners in their report recommend a reduction in the price of electricity, and commencing Nov. 1 the price will be reduced, the schedule to be issued 30 days previous. The profit from the department is due mostly to the electric service, which shows a profit of $19,823, while only $7,663 was made in the gas service. Electricity for operating the municipal electric plant will be furnished by the Uncas Power Company as soon as its dam at Scotland, Conn., is completed.

WASHINGTON, D. C.—Bids will be received by the Minister of the Interior, Cairo, Egypt, until Oct. 29 for the necessary equipment for installing an electric light system in the town of Zagazig. For further information address No. 2642, Bureau of Manufactures.

WASHINGTON, D. C.—The Direcion General de los Ferrocarriles del Estado San Eugenio, Chile, will receive bids for three 300-kw generators and other equipment for a 900-kw power station. For further information address No. 2640, Bureau of Manufactures, Washington, D. C.

WASHINGTON, D. C.—Proposals will be received at the office of the U. S. Capitol until Oct. 14 for about 25,000 electric lamps. Proposals to be submitted on the bidder's own letter head, or proposal form. Telegraphic proposals and telegraphic modifications of proposals will not be considered. Elliott Woods is superintendent of U. S. capitol, buildings and grounds.

JACKSONVILLE, FLA.—John N. C. Stockton, president of the Ortega Land Company, has been granted a franchise by the County Commissioners to build an electric railway from Jacksonville to Ortega, a distance of five miles.

PENSACOLA, FLA.—Surveys have been made on the property adjacent to Turner's Mill Pond for the installation of a hydro-electric plant. It is proposed to construct two re-enforced concrete dams and a power plant to be operated by two water turbines. Robert Graveley, of Mobile, Ala., is engineer in charge of the work.

TAMPA, FLA.—John A. Graham, of Bradentown, Fla., has applied to the City Council for a franchise to establish an electric light plant in Tampa.

ASHBURN, GA.—Bonds to the amount of $50,000 have been sold, the proceeds to be used for the construction of a municipal electric light plant, contract for which has been awarded to J. B. McCrary & Company, of Atlanta, Ga.

BRUNSWICK, GA.—The citizens on Sept. 26 voted to authorize the City Council to enter into a contract with the Mutual Light & Water Company to light the city and furnish water for a term of 10 years, on condition that an electric railway is to be built within a year.

DOUGLASS, GA.—An election will soon be held to vote on the proposition to issue $15,000 in bonds for extensions to the electric light system and water works.

EAST POINT, GA.—An election will be held Oct. 28 to vote on the proposition to issue $15,000 in bonds for improvements to the electric light plant. E. H. Davis is city engineer.

LIZELLA, GA.—A hydro-electric light plant of 75 hp has recently been installed by W. J. Marshall.

LYONS, GA.—The contract for the construction of the electric light plant and water works system has been awarded to W. J. Edwards & Company, of Atlanta, Ga.

MILLEN, GA.—J. B. McCrary & Company, of Atlanta, Ga., have been awarded the contract for constructing a lighting plant and water works system in Millen. W. O. Lumpkin will have charge of the work.

VOLLMER, IDAHO.—The electric light plant is nearly finished and will soon be ready to furnish electricity for lighting the streets and residences of the town. Arc lamps will be used for lighting the streets. The question of furnishing electricity for lamps in Ilo is under consideration.

AURORA, ILL.—The merchants have decided to award the contract for lighting the East Side business streets to the Western United Gas & Electric Company, as the cost would be less than to extend the distributing system of the municipal electric light plant to that district.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, until Oct. 10, for furnishing the Department of Electricity, city of Chicago, Ill., with 200 miles, approximately, of No. 6 B. & S.

gage triple braid, weatherproof, copper line wire. Proposals must be made out upon blanks furnished by the city electrician.

ELGIN, ILL.—Hamilton Browne, president of the Elgin & Belvidere Electric Company, Chicago, Ill., is said to be interested in organizing a company to be known as the Elgin Terminal Company to operate an electric railway from Wing Park to Fountain Square, and which will secure an entrance to this city for the electric railway of the Elgin & Belvidere Electric Company.

LEMONT, ILL.—Bids will be received by T. E. Sullivan, president Board of Trustees, until Oct. 14 for one 500-hp electric motor. Bids will also be received for one vertical single acting triplex electrical driven power pump with motor base and double reduction gears; also one electrical driven two-stage turbine pump with motor base.

YORKVILLE, ILL.—It is reported that the Joliet & Northwestern Electric Railway Company has secured the capital necessary for the construction of its proposed electric railway from Yorkville to Morris. The company also proposes to build an electric railway from Aurora to Sandwich, with a connection for Yorkville at Bristol. The power plant will be located at Yorkville. Hugh G. Palmer, of Yorkville, Ill., is chief engineer.

OWENSVILLE, IND.—C. J. Seibert, of Owensville, Ind., will have charge of the work of surveying the proposed interurban railway from this city to Evansville, for the Evansville, Mount Carmel & Olney Interurban Railway Company.

PATOKA, IND.—Surveys are being made by the Evansville & Southern Indiana Traction Company for the extension of its railway system from Patoka to Hazleton.

ATLANTIC, IA.—The contract for the equipment for the municipal electric light plant was awarded to the Skinner Engine Company, of Erie, Pa., for $1,250.

CLINTON, IA.—The Tri-City Telephone Company is planning extensive improvements to its system within the next few months which will involve an expenditure of about $100,000 and will include the building of a new exchange building and placing its wires in underground conduits. Allen G. Hawley is president of the company.

HARTLEY, IA.—The Sioux City & Spirit Lake Railway Company has awarded a contract to Westinghouse, Church, Kerr & Company, of New York, N. Y., for the construction of an electric railway from Sioux City to Spirit Lake. The officers of the street railway company are: Frank Patch, president; George Coleman, secretary; G. E. Knaak, treasurer; J. D. Browning, general manager, and L. A. Wakefield, chief engineer.

MALVERN, IA.—Preparations are being made by the Malvern Light, Power & Heating Company to extend its transmission lines to Tabor to furnish electricity for lamps, for which the company was recently granted a franchise.

NEVADA, IA.—Negotiations have been completed whereby the Nevada Mutual, Roland Mutual, Cambridge Independent, Maxwell and Short Line Telegraph Companies have been consolidated under the name of Story County Independent Telephone Company. The merger will give the company control of about 1700 telephones in the county and about 250 miles of toll line. The headquarters of the company will be located in Nevada. It is said that F. M. Boardman, manager of the Nevada Mutual Telephone Company, will be manager of the new company.

SIOUX CITY, IA.—The New State Telephone Company has purchased the Sioux Falls exchange and will operate it in connection with other lines. The branch includes about 1800 telephones and 250 miles of pole line. The consideration is said to be about $150,000.

TRAER, IA.—The capital stock of Traer Mutual Telephone Company has been increased to $72,000.

WAVERLY, IA.—It is reported that the City Council will take steps at once to rebuild the municipal electric light and water plants, recently destroyed by fire, causing a loss of about $50,000.

PITTSBURG, KAN.—The Joplin & Pittsburg Railway Company contemplates extending its railway from Mineral or Cherokee to Parsons and Cherryvale.

ALEXANDRIA, LA.—The Alexandria Electric Railways Company contemplates extending its railway system to the Kent Land Company's addition.

LAKE CHARLES, LA.—Plans are being made by the Lake Charles Railway & Light Company to construct an extension 1½ miles long. The company proposes to take over the property of the Lake George Street Railway Company.

WINNFIELD, LA.—H. W. Wright has been appointed by the city as superintendent of the construction of the new electric light plant and water works. Mr. Wright would like to receive catalogs and printed matter pertaining to the work.

MIDLAND, MD.—The Midland Electric Light Company is making plans to extend its electric lighting system to Lord.

LAWRENCE, MASS.—The Board of Aldermen has voted to cooperate in the building of a new interurban electric railway between Lawrence, Lowell and Boston to compete with the Boston & Northern Street Railway Company. Butler Ames, R. J. McCartney, L. E. Bennett and others are interested in the project.

PITTSFIELD, MASS.—It is stated that surveys are being made for the Pittsfield Street Railway Company for the proposed extension of its system from West Pittsfield to the State line.

HATTIESBURG, MISS.—It is reported that the Hattiesburg Traction Company will resume work on the construction of the local street railway system Dec. 1. The company has about five miles of track already laid. The company also proposes to erect a power station. S. E. Travis is president of the company.

KANSAS CITY, MO.—The Kansas City & Lee's Summit Electric Railway Company has made application to the County Court for a franchise for its proposed electric railway from Lee's Summit to this city.

ST. LOUIS, MO.—Two bills have been passed in the House of Delegates pertaining to the new city lighting contract, one of which provides for calling for bids on a 10-year contract to begin Sept. 1, 1910; the other authorizes the Board of Public Works to grant a franchise for the use of the streets to serve light and power. Through these measures it is hoped to bring other companies into the city, thereby creating competition. At present all public utilities, with exception of the water works, are controlled by the North American Company.

BUTTE, MONT.—The British Butte Mining Company is making arrangements for erecting a dredging plant on its property west of Butte, the cost of which is estimated at $80,000. The company has entered into a five-year contract with the Butte Electric & Power Company to furnish electricity to operate the plant.

HAVELOCK, NEB.—Preparations are being made by the Plattsmouth Telephone Company to make extensive improvements to its system in Havelock, which will include the construction of a new exchange building and extension to its outside system. The cost of the work is estimated at $10,000. P. H. Polleck is manager.

KEARNEY, NEB.—The Kearney & Loup Valley Railway Company is to be incorporated for the purpose of constructing an electric railway from Kearney through Pleasanton and up the Loup Valley with a branch line to Ravenna. W. L. Rand is said to be interested in the project.

BAYONNE, N. J.—The Coast Line Telephone Company has submitted a proposition to the City Council offering to build a system of conduits which will accommodate all the wires throughout the city, and rent them to all the companies which operate wires, and when the cost of the system and the maintenance has been paid by rentals the company offers to turn the system over to the city.

ALBUQUERQUE, N. M.—The Colorado Telephone Company is building a telephone line to Estancia and also contemplates extending its system from Santa Fé to Lamy and from there to Calisto to the south. A telephone line will also be erected from Estancia through the valley of Chima River to Abiquiu, up the Rio Grande Valley to Chemita, San Juan and Alcalde and from Espanola south to Santa Cruz. A. D. Graham is division superintendent.

FORT BAYARD, N. M.—Bids will be received by Captain S. P. Vestal, constructing quartermaster, until Oct. 23, for furnishing and installing electric light fixtures in the Administration Building at Fort Bayard.

BROADALBIN, N. Y.—The Public Service Commission, Second District, has authorized the Broadalbin Electric Light & Power Company to issue capital stock to the amount of $42,500 and $10,000 in bonds, the proceeds of both stocks and bonds to be used to pay the obligations of the company, amounting to $13,788, the remainder to be used for the construction of a dam, power house, equipment and transmission lines.

BUFFALO, N. Y.—The City Council has instructed the Commissioner of Public Works to have plans and specifications prepared for the installation of an engine and generator at the Hamburg Canal pumping station for the purpose of generating electricity for lamps and motors.

BUFFALO, N. Y.—The Buffalo Smelting Works, of Buffalo, is said to have completed arrangements for electrolytic refining of copper, electricity for which will be furnished by the Cataract Power & Conduit Company, of Buffalo. A contract has been placed with the Crocker-Wheeler Company, of Ampere, N. J., for a 500-hp motor generator set, which will be installed in the addition to the plant, recently completed.

DEPOSIT, N. Y.—Plans are being considered by the Deposit Electric Company to install an additional engine in its plant.

DUNKIRK, N. Y.—The Board of Water Commissioners has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for installing a new turbo-generator set in the municipal electric light plant, to cost $14,997. The machine will be a duplicate of the one installed six months ago.

MEDINA, N. Y.—A franchise has been granted to S. A. Cook & Company to operate an electric lighting and power plant, which will be driven by steam obtained from the heating distributing system. It is proposed to thus use the waste steam.

NEW YORK, N. Y.—Bids will be received by J. W. Stevenson, commissioner of bridges, until Oct. 12, for furnishing and installing the electrical equipment for the overhead trolley system of the Blackwell's Island Bridge over the East River, between the Boroughs of Manhattan and Queens.

ONTARIO, N. Y.—Plans are being made to install an electric plant in Ontario to light the streets and residences in the town. Electricity for operating the system will be furnished by the Sodus Gas & Electric Light Company, of Sodus, N. Y. The company is now furnishing energy for lamps in Williamson, and it is said that Williamson will be connected with the Ontario system. The Sodus Gas & Electric Company is plan-

ning to extend its system to Webster next spring to furnish electricity for lamps and motors. Contracts for machinery have already been placed.

PHILMONT, N. Y.—The Philmont Lighting & Power Company has applied to the Public Service Commission for permission to issue $7,000 in bonds, the proceeds to be used for improvements to its plant.

PLATTSBURG, N. Y.—The Public Service Commission has granted the Plattsburg Light, Heat & Power Company permission to dispose of its bond issue of $250,000, recently authorized, at 85, instead of 90, as required in the original order.

SCHAGHTICOKE, N. Y.—The Schenectady Power Company, successor of the Schaghticoke Power Company, has applied to the Public Service Commission, Second District, for a franchise to operate in the Village of Scotia. The company is building a new power plant in Schaghticoke, and will furnish electricity to the General Electric Company, in Schenectady, as soon as the plant is completed. The transmission lines will be 22 miles long.

SYRACUSE, N. Y.—It is reported that the Syracuse, Lake Shore & Northern Railroad Company will erect two power stations, one to be located near Phœnix, N. Y., and the other near Fulton, N. Y.

WATERTOWN, N. Y.—The Jefferson County Telephone Company has purchased a site for a telephone exchange.

EAST DURHAM, N. C.—The East Durham Cotton Manufacturing Company is preparing plans for changing the motive power for operating its mills from steam to electricity, the cost of which is estimated at $75,000. The work will include the construction of a new power house and a concrete reservoir, and the installation of a 750-hp Corliss compound condensing engine, six high-pressure boilers and an electric generator.

SPENCER, N. C.—It is reported that the electric light and power plant of the Southern Railway Company was destroyed by an explosion Oct. 1.

HARVEY, N. D.—Plans are being prepared by the Harvey Electric Light & Power Company for the construction of its new electric plant, which is expected to be completed early in November. The equipment will include a 150-hp boiler, a 125-hp Corliss engine and electric generator.

COLUMBUS, OHIO.—The capital stock of the Scioto Valley Traction Company has been increased from $3,000,000 to $3,500,000.

DAYTON, OHIO.—The Dayton Street Railway Company has filed amendments to its charter with the Secretary of State increasing its capital stock from $10,000 to $1,200,000.

DAYTON, OHIO.—Bids will be received until Oct. 19 at the office of the Board of Public Service for building and installing a storm pumping station and appurtenances, the installation of motors, electric lamps and all other electrical apparatus, pumps, automatic starting and stopping devices, oiling systems, etc. J. C. Ely is president of the board.

GALION, OHIO.—The capital stock of the Galion Telephone Company has been increased from $100,000 to $125,000.

NORWOOD (CINCINNATI P. O.), OHIO.—Arrangements are being made by the Pfau Manufacturing Company for the construction of a new plant to cost about $100,000, which will include the construction of a power house and electric plant.

PAINESVILLE, OHIO.—Bids will be received by the Court House and Jail Commission of Lake County at the office of the commission, Court House, Painesville, Ohio, until Oct. 26 for furnishing and placing fixtures for the Lake County court house and jail, now under construction, according to plans and specifications, which can be seen at the office of the auditor of Lake County, in said court house. C. H. Stocking is a member of the commission.

SPRINGFIELD, OHIO.—Negotiations have been completed whereby the People's Light, Heat & Power Company and the Home Lighting Heat & Power Company will be taken over and consolidated with the Springfield Light, Heat & Power Company, which was recently incorporated with a capital stock of $1,000,000. The purchase price of the Home company's plant is said to be $450,000 and the plant of the People's company is valued at $550,000. The new company will take over the property and the holdings of the two companies, and all contracts for light, heat and power held by either company will be fulfilled by the new company. John L. Zimmerman will continue as president of the company.

WARRENSVILLE, OHIO.—Bids will be received at the office of the Board of Public Service, City Hall, Cleveland, Ohio, until Oct. 10, for conduits only, for the wiring for Correction Square, Cooley Farms, Warrensville, Ohio. Plans and specifications may be seen and blank proposals obtained at the office of the Board of Public Service. W. J. Springborn is president Board of Public Works.

WOOSTER, OHIO.—The Wayne County Telephone Company, recently organized, will construct telephone lines throughout the country. L. D. Cornell, of Shreve, is attorney.

MANGUM, OKLA.—The citizens of Mangum, Reed and Vinson are considering the question of constructing an electric railway to connect the three towns. A committee consisting of T. P. Clay, of Mangum; F. J. Perrin, of Reed; A. P. Slusher, of Vinson, and others, has been appointed to consider the project and organize a company to construct the railway.

ASHLAND, ORE.—Bids will be received until Oct. 15 for machinery and apparatus for a power plant to be erected by the city on Ashland Creek Canyon, the cost of which is estimated at $66,000. Frank Kelsey, Corbett Building, Portland, Ore., is engineer.

GRANT'S PASS, ORE.—Plans are being made by the Rogue River & Oregon Southern Railway Company to build an electric railway from Grant's Pass to Kirby, Ore., a distance of 30 miles. G. A. Collins is president and chief engineer.

SUMPTER, ORE.—The Red Boy Mine, 18 miles west of Sumpter, is now operated by electricity furnished by the plant located on Olive Lake, six miles distant.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 26, for furnishing generators, engines, electrical supplies, naval brass, sheet copper, brass and copper tubing, chain, wire cable, wire, etc. Blanks and general information relating to this circular (472) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

BEAVER, PA.—The residents of College Hill have decided to have the borough rebuild the electric plant, which was wrecked some time ago, and continued under municipal ownership. The proposed plant will cost about $15,000, and the equipment required will include boilers, generators, switchboards and other apparatus.

LAMBERTSVILLE, PA.—The Central Telephone Company contemplates extending its telephone lines from Shanksville to Colemans and Lambertsville, in the near future.

LINESVILLE, PA.—The capital stock of the Linesville Telegraph & Telephone Company has been increased from $6,000 to $25,000.

LOCK HAVEN, PA.—The Nisbet Rural Telephone Company is planning to erect telephone lines to Bastress, Oval, Collumsville and other points in Nippenose Valley. Wilbur Sallada, of Williamsport, is president of the company and W. C. Carson, of Duboistown, secretary.

MANSFIELD, PA.—The Tioga Traction Company is being organized for the purpose of constructing an electric railway from Mansfield to Wellsboro. W. A. Selts, of Jersey Shore, Pa., is interested in the enterprise.

NORRISTOWN, PA.—The contract for making the necessary changes in the power house and the installation of 250 arc lamps has been awarded to the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., by the Borough Council. The present street lighting system will be replaced by 4-amp luminous arc lamps.

SHAMOKIN, PA.—The Roaring Creek Valley Telephone Company will extend its telephone lines from Numidia to Ringtown and also down to Bear Gap.

WASHINGTON, PA.—Contracts have been placed for extensive improvements to the plant of the National Telephone Company in Washington, Pa., work on which will commence at once. The improvements include the installation of an automatic switchboard and stringing cables, most of which will be placed underground in the entire city. John A. Howard is president of the company.

SPARTANBURG, S. C.—Plans are being prepared by the Crescent Manufacturing Company to operate the machinery in its plant by electricity, instead of steam power, in the near future.

ERWIN, TENN.—The city officials are considering the question of granting a franchise for supplying electricity for lamps and motors in Erwin.

AUSTIN, TEX.—A syndicate headed by William D. Boyce, of the Boyce Construction Company, of St. Louis, Mo., is promoting the construction of an extensive electric railway system in Central Texas. It is stated that all arrangements for financing the road have been made. The first section to be constructed will run between Temple and Waco, by way of Marlin, a distance of about 50 miles. The second division will run from Temple south to Austin, a distance of about 60 miles. It is planned to erect a power plant at Temple at a cost of about $200,000. This plant will supply electricity for the whole system, including a proposed extension from Austin to San Antonio, about 80 miles in length.

HOUSTON, TEX.—The County Commissioners have granted the Brunner Water & Light Company a franchise to erect a water and light plant. The company is capitalized at $50,000. L. N. Yarbrough is treasurer and general manager.

AMERICAN FORK, UTAH.—Surveys have been completed for the proposed power plant of the Utah Light & Power Company, to be located in Alpine Canyon. John H. Wooton is manager.

BELLINGHAM, WASH.—Surveys are now under way on the upper Skagit River for the installation of water power plants to develop 75,000 to 100,000 hp. Water rights have been taken out on the Skagit, and all its tributaries, above Bacon Creek. The first plant will be erected at the intersection of Skagit River and Bacon Creek, to develop about 10,000 hp, from which power will be obtained to push the work farther up the river. C. L. Mitton, civil engineer, is now running a line for the three-mile tunnel at Rockport, to secure a 260-foot fall at that point. Water rights have been filed by A. Freeman, of Anacortes, and B. Thomas, consulting engineer for the Seattle Electric Company.

CHENEY, WASH.—The Washington Water Power Company has been awarded a contract to furnish electricity for lighting the streets of the town for a term of five years. The street lighting system consists of 35 incandescent lamps of 50 cp.

EDMONDS, WASH.—The Edmonds Electric Light & Power Company is planning to build an electric light and power plant at Edmonds, contract for which has been awarded. The cost of the plant is estimated at $10,000, and it will have an output sufficient to supply 1500 lamps. Arrangements have been made to install additional units as required. A 200-hp engine, using coal and oil as fuel, is to be installed for the first unit. Work on the plant will begin at once. Mr. Ammon is one of the incorporators.

ESPANOLA, WASH.—The County Commissioners have granted N. O. Weyen a franchise to erect a telephone system in Espanola.

GREAT FALLS, WASH.—The Great Falls Water & Power Company is making preliminary arrangements for a water power development at the falls on the Missouri River. It is said that 10,000 hp will be developed.

HUSUM, WASH.—J. T. Thompson, of The Dalles, Ore., will install an electric light and pumping power plant at this place. Power for operating the plant will be secured from White Salmon Falls, at Husum.

KENNEWICK, WASH.—The Northwest Light & Water Company has entered into a contract with the Northern Pacific Irrigation Company to furnish electricity for operating the pumps of the irrigation system of the latter company. The contract provides for installation of a steam power plant as an auxiliary to a transmission line to be erected from the hydro-electric plant of the Northwest Light & Power Company, located on the Natchez River in Kennewick. Pumps will be installed and pipe lines constructed at once; orders have been placed for the transmission line, and it is expected to have the system completed before April 1, 1909. R. E. Strahorn is president of the power company.

NORTH YAKIMA, WASH.—The Northwest Light & Water Company has purchased the water and light plants of the Kennewick Electric Company, for $75,900, and has also taken over the system of the Pasco Water & Light Company. The Northwest Light & Water Company will extend its transmission lines from this city to Pasco and intervening towns, and will enlarge and improve its plant. George Arrowsmith is manager.

SEATTLE, WASH.—Bates & Clark, electrical engineers and contractors, Seattle, Wash., have been awarded the contract for furnishing a generator and engine for the asphalt plant and refuse destructor at Seattle for $3,670.

SEATTLE WASH.—New cluster street lamps are being erected on Third Avenue between Pine and Jackson Streets. The cost is estimated at $48,000, of which two-fifths will be paid by the abutting property owners, and remainder to be paid by the city.

SPOKANE, WASH.—Application has been made to the City Council by the Spokane Traction Company for a blanket franchise to extend its street railway system in the east and southeastern parts of the city.

VANCOUVER, WASH.—The County Commissioners have granted the petition of the Portland Light & Power Company for a franchise to erect transmission lines over certain county roads for the transmission of electricity, but inserted the clause that the electricity must be generated within the State of Washington. The action of the commissioners is to forestall the possibility of the company laying a cable across the Columbia River and transmitting electrical energy from its plants in Oregon, which would probably result in the closing down of the plant in Vancouver.

WENATCHEE, WASH.—The electric lighting plant of the Wenatchee Electric Company was partially destroyed by the explosion of the gas tank recently. Power for operating the plant is being supplied temporarily from the plant on Swillcup Creek.

McMECHEN, W. VA.—W. Bateson & Company, of Wheeling, W. Va., have secured the contract for the construction of the power house at Dam No. 13, near McMechen, to cost about $30,000.

MARTINSBURG, W. VA.—It is reported that application has been made by J. C. Anderson and R. M. Johnson, of Norfolk, Va., for an electric railway franchise for the Berkley Traction Company in Martinsburg for its proposed interurban railway from Shepherdstown, via Martinsburg, to Winchester, Va.

BIG FALLS, WIS.—The Wall-Spalding Lumber Company, owner of the water rights at Big Falls, is replacing the present dam with a concrete structure at a cost of about $200,000. It is said that the company contemplates generating electricity to be furnished to towns in this vicinity.

CEDAR GROVE, WIS.—The question of establishing an electric light plant in this village is now under consideration.

DELAVAN, WIS.—W. H. Tyrrell has been appointed receiver of the Delavan Light & Power Company at the request of the bondholders. The company was organized about 10 years ago by local capitalists.

MARINETTE, WIS.—The Daggett-Nathan Telephone Company has filed amendments to its charter changing its name to the Daggett-Nathan-Faithorn Telephone Company. The capital stock is placed at $4,000 and plans are being made to make further extensions to its telephone lines.

MINOCQUA, WIS.—The local telephone company is planning to install a new telephone exchange at once.

MONROE, WIS.—Plans are being made by the United Telephone Company to extend its telephone line into Washington Township, a distance of eight miles.

ROCKLAND, WIS.—The capital stock of the Rockland Telephone Company has been increased from $1,500 to $3,000.

TIGERTOWN, WIS.—Herman Swanke is reported to be interested in a project to build an electric light plant and concrete dam.

LETHBRIDGE, ALB., CAN.—Mayor Henderson is advocating an electric street railway system for this city and favors granting a franchise.

VICTORIA, B. C., CAN.—Owing to the shortage of water at Coldstream, the British Columbia Electric Street Railroad Company has had to curtail its service in this city and has issued notices to the effect energy will be turned off between 4 a. m. and dusk. R. H. Sperling is general manager.

VICTORIA, B. C., CAN.—The directors of the British Columbia Electric Street Railroad Company have voted to spend $1,500,000 for the construction of an auxiliary water power at Jordan River. A report has been prepared by Wynn Meredith, consulting engineer, which is to be passed on by the directors in London, Eng. R. H. Sperling, of Vancouver, is general manager of the company.

BERLIN, ONT., CAN.—The Almoga Power Company, which is constructing a power plant at Michipicoten Falls, Ont., is already increasing the output of the plant by the installation of a second unit of 1000 hp, and a third unit of 400 hp; also a separately driven exciter set of 125 hp for the whole station. The plant, although not completed, was put into commission last January, furnishing several gold mines in the Michipicoten District with electricity. The company has recently entered into a contract with the Lake Superior Corporation to supply electrical energy to operate its Helen iron mine, which will require the immediate erection of a 12-mile transmission line and the installation of electrical equipment in the mine of over 1000 hp in motors, as well as new generating apparatus at the power station. The contract is to take effect from Dec. 1 and is for a period of 10 years. The electrical equipment has already been purchased. C. H. Mitchell, Traders' Bank Building, Toronto, Ont., is engineer.

GLENCOE, ONT., CAN.—Owing to the failure to make satisfactory terms with the electric light company for lighting the city by electricity, the Council has decided to submit a proposition to the ratepayers to establish a municipal electric light plant.

HAMILTON, ONT., CAN.—The City Council has granted the Bell Telephone Company an exclusive franchise in this city for a term of five years, in return for which the company agrees to pay the city $4,000, and to furnish the city with 25 additional telephones, making a total of 150, at the rate of $25 each per year. Under the old franchise the company paid the city $2,900 per year.

EDGEWOOD, CAL.—A new electric power plant is being erected in Edgewood, at a cost of about $8,000.

LATCHFORD, ONT., CAN.—Boston and Buffalo capitalists will erect an electric smelter in Latchford at a cost of $200,000.

FORT SASKATCHEWAN, SASK., CAN.—The local electric lighting company has shut down, and it is expected this town will be without electricity for lamps and motors for the coming winter unless some company seeks a franchise.

DAWSON CITY, Y. T., CAN.—The Yukon Basin Gold Dredging Company has acquired a volume of water on Stewart River capable of developing 87,000 hp. The plant will furnish electricity to operate the gold dredges and will also supply electrical energy to the camps.

SALTILLO, MEX.—An extensive electric street railway system is to be constructed in the city of Saltillo by Schondube & Neugebaur, of Mexico City. The more important suburbs will be given connection with the town.

New Industrial Companies.

THE U. S. MAGNETO COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $150,000, to manufacture electric motors and appliances, by C. J. Dannenbaum, W. D. Pennington and G. T. Olsen, of Chicago, Ill.

THE MOVING SIGN COMPANY, of Boston, Mass., has been incorporated to do general advertising by the use of electric moving signs. The company is capitalized at $50,000, and the officers are: C. B. Battey, president, and T. S. McGowne, of Boston, Mass., treasurer.

THE GRAY-ALDRICH COMPANY, of Boston, Mass., has filed articles of incorporation, with a capital stock of $25,000, for the purpose of manufacturing gas, gasoline, marine and stationary engines. E. Gray is president, and C. S. Aldrich, of Dorchester, Mass., treasurer of the company.

Company Elections.

JAMESTOWN, N. Y.—At the annual election of the Jamestown Lighting & Power Company the following named officers were elected: Harry P. Sheldon, president; John T. Wilson, vice-president, and Albert S. Price, secretary and treasurer.

DENVER, COL.—At the annual meeting of the Summit County Power Company the following named officers were elected: H. L. Doherty, chairman of the Board of Directors; W. J. Barker, president; W. C. Sterne, vice-president and general manager; Clare N. Stannard, secretary; F. W. Frueauff, treasurer, and John T. Brady, assistant treasurer.

New Incorporations.

GRAND BAY, ALA.—The Grand Bay & Union Telephone Company has been organized and the following named officers elected: John Jagger, president; J. Stevens, vice-president; M. A. Fort, secretary. Plans are being considered for the construction of a telephone system in Grand Bay and other branches with a central exchange. The line in Grand Bay will be about 20 miles in length.

LIVE OAK, CAL.—The Live Oak & Encinal Light & Power Company, capitalized at $20,000, has recently been incorporated by residents of Live Oak and Encinal.

SACRAMENTO, CAL.—The Sacramento Terminal Company has been incorporated with a capital stock of $250,000, and the following named directors: Herbert W. Furlong and Charles W. Harmon, of Berkeley, Cal.; W. G. Hyde, John Leechman and Chauncey J. Goodrich, of San Francisco. The company has been formed for the purpose of financing the Northern Electric Railway Company's plans for the completion of its terminal in the town of Broderick, across the river from Sacramento. The new company will operate two railways from Sacramento to Broderick, connecting with the Northern Electric Company's system in Sacramento.

SAN FRANCISCO, CAL.—The Northern California Power Company, Consolidated, has been organized, with a capital stock of $10,000,000, for the purpose of taking over the property and the holdings of the Northern California Power Company. Owing to the limited capitalization of the Northern California Power Company, it cannot authorize an additional issue of bonds necessary to adequately serve the present or meet the future demands made upon it. In order to provide means to finance the new work contemplated, a new corporation has been formed. A meeting of the stockholders of the new company has been called for Nov. 11 to vote on a proposition to issue $10,000,000 in bonds. Arrangements are being made whereby the new company will secure the capital stock of the companies now controlled by the Northern California Power Company, and also a transfer of their physical properties as follows: Red Bluff Electric Light & Gas Company, Tehama Electric Company, Keswick Electric Power Company, Battle Creek Power Company, Redding Electric Light & Gas Company and the Willows Water & Light Company. Temporary officers were elected as follows: C. B. Morgan, president; Dudley C. Bates, vice-president, and E. H. Nuhrenberg, secretary.

WILMINGTON, DEL.—The Nebraska Power Company has filed articles of incorporation with the Secretary of State at Wilmington, Del. The company is capitalized at $12,000,000, and the incorporators are: W. J. McEathron, of Omaha, Neb.; H. E. Babcock, of Columbus, Neb., and H. W. Davis, of Wilmington, Del.

GAINESVILLE, GA.—The Georgia Power Company has been incorporated, with a capital stock of $1,500,000, with privilege of increasing it to $10,000,000, by G. H. Prior, James A. Rudolph, of Gainesville, Ga., and J. J. Spalding, of Atlanta, Ga. The company proposes to acquire and develop water powers and operate electric plants, etc.

CHENOA, ILL.—The Chenoa Telephone Company has been organized and the following-named directors elected: F. B. Elfrink, W. R. Shinn, John N. Gentes, John N. Parsons and John F. Johnson.

CHICAGO, ILL.—Articles of incorporation have been filed for the River Forest Railroad Company to construct a railway from Oak Park to the Village of River Forest. The incorporators are William T. Nelson, F. C. Cleveland and others.

RUSHVILLE, ILL.—The Ray & Rushville Mutual Telephone Company has been chartered, to operate a telephone system between Ray and Rushville, by Henry G. Teel, Thomas Ashwood and H. B. Anderson.

LOUISVILLE, KY.—The East End Electric Company has been organized and will in the near future make application to the City Council for a franchise to generate electricity for lamps and motors in the East End of Louisville. The company will be capitalized at $100,000, and the officers are: Nathan Foening, president; Percy Sternau, vice-president, and B. Albus, secretary and treasurer.

NEW ORLEANS, LA.—The Grand Isle Development & Construction Company has been incorporated, with a capital stock of $300,000, to construct an electric railway from New Orleans to Grand Isle as projected by the New Orleans & Seashore Air Line Railway Company. The directors are L. H. Marene, Sr., L. H. Marro, Jr., W. T. Stephens, Seeley Dunn and Charles Farwell.

PORTLAND, MAINE.—The Minnesota & Ontario Power Company has been incorporated, with a capital stock of $5,000,000, and the following-named officers: T. L. Croteau, president, and F. H. Morrill, of Portland, Maine, treasurer.

ROLLINGSTONE, MINN.—Articles of incorporation have been filed for the Rollingstone Telephone Company, with a capital stock of $10,000, by Henry Speltz, N. M. Reilland and Andrew Rinn, Jr., all of Rollingstone.

BENNINGTON, NEB.—The Farmers' Telephone Company has been incorporated, with a capital stock of $1,000, by Henry J. Fesemann and George F. Logeman.

OMAHA, NEB.—The Nebraska Traction & Power Company has been chartered with a capital stock of $2,000,000 to build an electric railway from South Omaha to Ralston, a distance of six miles. The power station will be located at Ralston. The incorporators are: M. Uhl, J. F. Emmert, W. D. Crist, N. P. Dodge, Jr., and F. N. Howard.

ROCHESTER, N. Y.—The Rochester, Corning & Elmira Traction Company has been authorized by the Public Service Commission to issue the first installment of $1,000,000 in bonds. The company proposes to build an electric railway between Rochester and Elmira; the first section to be built will run from Rochester and Lakeville, on Conesus Lake. L. Feuerstein, of Rochester, is engineer.

AKRON, OHIO.—Application has been made for a charter by the Turkeyfoot Traction Company to build an electric railway between Akron and Massillon. The directors are Thomas L. Childs, Charles Esselburn, Charles J. Carey, Frank Ream and D. W. Ruesgegger.

CANTON, OHIO.—Articles of incorporation have been filed for the Center Valley Power & Light Company, with a capital stock of $100,000, for the purpose of furnishing light, heat and power.

CROOKSVILLE, OHIO.—Articles of incorporation have been filed for the Perry Electric Company, with a capital stock of $10,000, by J. Edward Horn, J. C. Horn and others.

CUMBERLAND, OHIO.—Articles of incorporation have been filed for the Buffalo Valley Telephone Company by T. M. Hathaway, Cary McLelland, C. A. Turner, F. M. Frisbee, J. D. Collins and Harry McCracken. The company is capitalized at $1,000.

EAST LIVERPOOL, OHIO.—The Pittsburg & East Liverpool Electric Railway Company has been formed to construct an electric railway from Pittsburg to East Liverpool, 34 miles in length. The officers of the company are Prof. J. M. Reed, of Dravosburg, president; A. Moore Buchanan, of Morgantown, W. Va., secretary, and J. C. McClaren, of Murdocksville, treasurer.

MILFORD, OHIO.—The Milford Home Telephone Company has been incorporated, with a capital stock of $10,000, by D. C. Warner and others.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company, of Springfield, Ohio, has been incorporated, with a capital stock of $1,000,000, by Joshua D. Price, William H. Sharp and L. M. Ferguson, of Columbus, and W. W. Keifer, Charles S. Kay and F. M. Hagan, of Springfield. The company will take over the properties of the People's Light, Heat & Power Company and the Home Electric Light Company. There will be an interchange of stock with the People's Light, Heat & Power Company, but the property of the other company will be bought outright, as the owners refuse to make the change any other way. The stockholders of the People's company have given consents to this effect.

WARREN, OHIO.—The Trumbull & Mahoning Electric Company has been organized and proposes to construct a dam across the Mahoning River, two miles above the water-works dam, to furnish power to generate electricity to be used for lamps and motors. The company will soon apply to the town officials for a franchise to operate an electric plant in Warren.

ZANESVILLE, OHIO.—The Zanesville & Meigs Valley Traction Company has been organized to construct an electric railway from Zanesville to Beverly, Ohio, via McConnellsville. The company is capitalized at $10,000 and the officers are: E. R. Meyer, president; F. M. Cruise, secretary; A. J. Longstreth, treasurer, and H. D. Blodgett, general manager, all of Zanesville.

GRANT'S PASS, ORE.—The Rogue River & Oregon Southern Railway Company has been chartered, with a capital stock of $1,000,000, to construct an electric railway from Grant's Pass, Ore., to Waldo, Ore., a distance of about 50 miles. The principal office of the company will be located in Seattle, Wash. The incorporators are O. S. Blanchard, Glenville A. Collins and H. B. Buddenburg, all of Grant's Pass.

THE DALLES, ORE.—The Cascade Development Company has filed articles of incorporation with a capital stock of $100,000 for the purpose of constructing and operating pipe lines, flumes and ditches for domestic power and irrigation purposes. The company is preparing plans for the construction of a power plant on Lindsay Creek, near Wyeth Station, where 350 horse power will be developed. The incorporators are: A. W. Mohr, W. A. Johnston, of The Dalles, and P. L. Caples, of Portland.

AVONDALE, PA.—The John's River Light, Heat & Power Company has been incorporated, with a capital stock of $500,000, to furnish light, heat and power by electricity or gas. The incorporators are: Elislia W. Meloney, of Avondale, Pa.; Benjamin F. Groff, of Lancaster, Pa., and Charles B. Evans, of Newark, Del. Notice of the incorporation of this company was published under Wilmington, Del., in our issue of Oct. 3.

CALLENSBURG, PA.—The Callensburg Telephone Company has been incorporated, with a capital stock of $6,000, and the following-named directors: J. A. Tosh, of Callensburg, treasurer; M. M. Best, of Turnipole, Pa.; A. R. Lobaugh, J. C. Waddell, D. E. Elliot, of Callensburg, Pa.; Fred McCall, of Bela, Pa.; J. W. Hartman, of Sligo, Pa., and others.

JOHNSTOWN, PA.—The Johnstown & Gallitzin Street Railway Company has been organized to build an electric railway from Johnstown to Gallitzin, a distance of 32 miles. The cost of the road is estimated at $1,250,000. The officers of the company are: Wallace Sherbine, of Wilmore, Pa., president, and H. H. Storey, of Johnstown, general counsel. This company is to be a successor of the Johnstown, Ebensburg & Northern Railroad Company.

LEWISTOWN, PA.—The Ferguson Valley Farmers' Telephone Company has been incorporated, with a capital stock of $5,000. The directors are: C. G. Kaufman, of Lewistown, Pa., treasurer; J. C. Shahen, Earl Kochenderfer, L. H. Ruble, of Lewistown, Pa.; M. F. K. Swigart, H. M. French, A. S. McKee, of McVeytown, Pa.

McALLISTERSVILLE, PA.—The Lost Creek Valley Telephone Company has been incorporated with a capital stock of $5,000.

MACUNGIE, PA.—The Macungie Electric Light, Heat & Power Company has been organized for the purpose of establishing an electric plant to furnish electricity for lamps and motors in Macungie. The capital stock of the company is placed at $5,000, and application for a charter has been applied for. The officers are: Charles H. Neumoyer, president; W. N. Decker, secretary, and H. L. Hertzog, treasurer.

MAHONING, PA.—The Mahoning Rural Telephone Company has been organized, with a capital stock of $5,000, and the following-named officers: W. A. Wertman, president; E. E. Wessner, secretary, and Jacob Zehner, treasurer.

MANTZ, PA.—The Mahoning & Lizard Telephone Company will soon apply for a charter to construct a telephone line from Tamaqua through Mahoning and Lizard Creek valleys to connect with the Bell Telephone Company.

PLYMOUTH, PA.—Articles of incorporation have been filed for the consolidation of the Wyoming Gas & Electric Company and the Luzerne County Gas & Electric Company, under the name of the Luzerne County Company. The capital stock of the company is placed at $2,000,000. P. Curtis, of Philadelphia, Pa., is president of the company.

PORTERSVILLE, PA.—The Portersville Telephone Company has been incorporated, with a capital stock of $12,000, and the following directors: Edwin W. Humphrey, of Portersville, Pa., treasurer; E. A. Watson, of Isle, Pa.; J. C. Wright, of Fombell, Pa.; J. F. Smith, of Pleasant Hill, Pa.; W. F. Book, of Grantboro, Pa.; N. L. Garnner, of Jacksville, Pa; E. P. Critchlow, of Prospect, Pa., and others.

SNOW SHOE, PA.—The Snow Shoe Electric Light & Power Company has filed articles of incorporation, with a capital stock of $5,000. The directors are: George B. Uzzell, treasurer; James F. Uzzell, J. G. Uzzell, all of Snow Shoe, Pa.; David Chambers and W. E. Brown, of Clarence, Pa.

WICONISCO, PA.—The Wiconisco Electric Light, Heat & Power Company has been incorporated, with a capital stock of $5,000.

ROCK HILL, S. C.—The Rock Hill Telephone Company has been incorporated, with a capital stock of $50,000, and the following officers elected: J. F. Le Claire, president, and P. Workman, treasurer, both of Rock Hill, S. C.

RAPID CITY, S. D.—Articles of incorporation have been filed for the Dayton & Western Railway Company by A. M. Lanphere, W. H. Lanphere, T. A. Mair, Knute Klenen, J. W. Cook, all of Rapid City, S. D. The company is capitalized at $100,000, and proposes to construct an electric railway from Rapid City, a distance of 20 miles, with the privilege to extend the railway into Wyoming.

RAPID CITY, S. D.—Articles of incorporation have been filed for the Rapid City & Wyoming Railway Company, with a capital stock of $500,000, for the purpose of constructing or purchasing a railway from Rapid City to Mystic, a distance of 35 miles. The incorporators are: H. W. Jones, H. E. Swander, L. A. Richards. J. C. Haines, E. M. Reeves, F. H. Rugg, G. P. Bennett, W. F. Pascal and Thomas Sweeney, all of Rapid City, S. D.

EATON, TENN.—Articles of incorporation have been filed for the Eaton Telephone Company by J. W. Smith, C. F. Inman, T. Robinson and others.

UNAKA SPRINGS, TENN.—The Unaka Traction Company has been incorporated by Isaac Love, W. B. McNabb, A. M. White, F. B. Vines and J. A. Johnson, to construct a street railway from Erwin to Johnson City, through Unaka Springs. The capital stock of the company is placed at $10,000.

BELLO, P. O. WESTHOFF, TEX.—The Bello Telephone Company has been incorporated to establish a telephone system in Bello. The officers of the company are: Gustav Thieme, president; D. S. Pearce, vice-president; George C. Rehmet, secretary and treasurer.

CORSICANA, TEX.—The Central Traction Company has been incorporated under the laws of Delaware to construct an electric railway from Corsicana to Palestine. The company is capitalized at $300,000, and the incorporators are: J. J. Sears, of Aledo, Tex.; J. O. Howard, Houston, Tex.; W. W. Clopton and J. V. Watkins, of Corsicana, Tex., and Henry W. Davis.

EL PASO, TEX.—It is reported that about $40,000 has been pledged by local land owners to build an electric railway from El Paso to Fabens to the El Paso Valley & Fort Hancock Electric Railway Company, which was recently formed to build the railway. It is said that as soon as $50,000 is pledged the stockholders will complete the organization of the company and ask for a franchise. J. S. Reynolds, Charles N. Bassett and Felix Martinez are interested in the project.

GODLEY, TEX.—The Godley Independent Telephone Company has been incorporated, with a capital stock of $3,200, by B. B. Robinson, J. A. Dalton, C. D. Odom and John R. Beaver.

FREDERICKSBURG, VA.—The Fredericksburg & Wilderness Telephone Company has been incorporated, with a capital stock of $1,000 and the following officers: T. F. Morrison, president; R. A. Jennings, of Orange, Va., vice-president; M. W. Thornburn, secretary and treasurer.

OLYMPIA, WASH.—A. Z. Smith Electric Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $50,000, and the incorporators are A. Z. Smith and Joseph Hertogs.

TENINO, WASH.—Deschutes Railway & Power Company has been incorporated by William McArthur and J. B. Taylor, with a capital stock of $500,000.

FAIRMONT, W. VA.—The Independent Power & Light Company has been incorporated, with a capital stock of $50,000, by L. C. Wyer, A. H. Donnally, J. R. Lynn and others.

OAKDALE, W. VA.—Articles of incorporation have been filed for the Oakdale Telephone Company, with a capital stock of $1,000, by J. R. Boyd and others.

ROMNEY, W. VA.—The People's Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by W. N. Guthrie, James C. Heath, C. Heath, C. H. Cookus and others.

ROMNEY, W. VA.—The People's Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by J. B. Byre, of Augusta, W. Va.; W. N. Guthrie, James C. Heath, C. H. Cookus, of Romney, W. Va.; K. Taylor, of Statesville, and J. M. Millison, of Higginsville, W. Va.

WILSON, Wis.—The Cady Telephone Company has been incorporated with a capital stock of $5,000 by S. L. Pickett, G. W. La Pointe, Jr., Martin D. Erickson, Frank Smith, David Cushing and Peter Simonson.

LETHBRIDGE, ALB., CAN.—The Lethbridge Radial Tramway Company has been incorporated to construct and operate an electric railway in and around Lethbridge. The capital stock of the company is placed at $100,000, with bonding privileges of $10,000 per mile. The directors are: W. Henderson, C. F. P. Conybeare, M. Freeman, F. H. Newburn, H. T. Cherry, W. Hardy and B. M. Jones, Lethbridge, Alb. It is understood the company will start work this fall.

PINCHER CREEK, ALB., CAN.—The Crow's Nest & Prairie Electric Company has been incorporated to build an electric railway from a point near the western end of Crow's Nest Lake through Coleman, Blairmore, Frank, Bellevue, Lundbruck and Cowley to Pincher Creek. The incorporation provides for a stock issue of $150,000 and a bond issue of $100,000 per mile. The incorporators are: A. Cameron, D. J. McIntyre, W. R. McRae, of Coleman, Alb.; T. Smith, of Frank, Alb.; J. H. Schofield, of Pincher Creek, Alb.

RED DEER, ALB., CAN.—The Red Deer Railway Company has been chartered to construct and operate an electric railway in the town of Red Deer and thence to Content, with a branch to the coal fields on the Red Deer River, and also from Content to Nevis. The company is capitalized at $100,000 and the incorporators are: G. W. Smith, J. J. Gaetz, F. W. Galbraith, W. A. Moore and J. C. Moore, all of Red Deer.

BLENHEIM, ONT., CAN.—The Farmers' Long Distance Telephone Company, Ltd., has been incorporated, with a capital stock of $40,000.

PALMERSTON, ONT., CAN.—Articles of incorporation have been filed for the Hawthorne Hill Rural Telephone Company, Ltd., with a capital stock of $10,000.

TORONTO, ONT., CAN.—The Toronto & York Radial Railway Company is said to be making arrangements to extend its railway from Yonge Street to Markham Village to Locust Hill, and will eventually extend its system to Port Perry. W. H. Moore is general manager.

Legal.

TELEPHONE COMPANY NOT LEGALLY RESPONSIBLE FOR INJURY CAUSED BY SAGGING WIRE.—A tree standing near a pole which supported defendant's telephone wire at a crossing of a highway fell, causing the wire to sag and hang down across the highway. The overseer of highways removed the fallen tree and attached the wire to another tree, from which three days later it became detached by the action of the wind, so that it again hung low over the highway. Some time later the plaintiff was driving a horse and carriage along the road and the top of the carriage was caught by the wire, overturning the carriage and injuring the plaintiff. It appeared that, if the wire had touched the ground, the circuit would have been broken, thereby notifying the defendant company of the defect, but, under the circumstances, the company received no notice until after the accident. It was held that the company was free from liability. The following is quoted from the opinion of the Court: "The only claim of negligence that can be made against the defendant, it seems to me, is in not discovering and repairing the injury to its line between the time of the happening of that injury and the time the accident occurred. . . . The peculiar character of this accident to the wire of the defendant and its attendant circumstances are of such a nature as not to have reasonably been anticipated by the defendant, and therefore it was not called upon, in the exercise of reasonable diligence, to guard against them. While the defendant might reasonably anticipate that its wires might become broken or dislodged, it could also reasonably anticipate that it would have prompt and immediate notice of that fact by interruption of the communication." Fitch vs. Central New York Telegraph & Telephone Company, 59 N. Y., Supp. 140 (Appellate Division, Third Department).

POSTAL TELEGRAPH COMPANY WIN SUIT IN OREGON.—In overruling the demurrer of the defendant in the case of the Pacific Coast Telegraph-Cable Company vs. the Oregon & California Railroad Company and the Southern Pacific Company, Judge Wolverton, of the United States Circuit Court at Portland, Ore., renders a decision which not only is of great importance to the parties to the action, but which will have a very important bearing upon the question of eminent domain. The telegraph company is trying to condemn a right of way over the railroad's right of way from Portland to the southern boundary of the State; the railroad company refuses to allow it to use the land. The railroad company holds its right of way under the right of eminent domain, and claims that this right ceases to be operative after it has once been exercised and the land is held under such condemnatory proceedings. The Postal Telegraph Company, on the other hand, claims that it has as good a right to condemn a right of way held by the railroad company as over any other private land. It is this question which the judge decides, holding that the telegraph company is right in its contention. He says that he is led firmly to the conviction that "under the general law coupled with statutory authority for the exercise of the right of eminent domain, property devoted to one public use through quasi-public concerns may be taken for another public use for like concerns, where the taking will not materially impair or interfere with, or is not inconsistent with, the use already acquired and is not detrimental to the public. The prime essential is that the two uses may stand together, and it is not of vital consequence that some inconvenience may result to the prior occupant, so that the latter suitor does not interpose in such a manner as to materially interfere with the practical use of the antecedent franchise." The demurrer is, therefore, overruled. The railroad company has a right of way 100 ft. wide to the southern boundary of the State, and the telegraph company claims the right to condemn over this right of way a right of way for itself 35 ft. on each side of the center of the road.

Personals.

MR. JOHN BOGART, the consulting engineer, has removed his offices to 141 Broadway, New York City.

MR. H. W. WRIGHT has been appointed by the city of Winnfield, Ala., superintendent of construction of the municipal electric lighting plant and waterworks about to be erected.

MR. THOMAS PENNEY has been elected president of the International Railway Company of Buffalo, to succeed Mr. Henry J. Pierce, who resigned to devote his time to The Amsterdam Corporation of New York City.

DR. C. C. GARRARD has resigned as manager of the instrument and transformer department of Ferranti Limited, in order to take up the position of manager of the switch department of the General Electric Company, Ltd., of London, England.

MR. W. J. WILGUS has resigned as consulting engineer of the New York City Public Service Commission and will, it is reported, submit a plan to the commission for the construction by private capital of a subway for freight traffic along the water front of Manhattan.

MR. EUGENE CREED has resigned from the staff of the sales department of the Narragansett Lighting Company, of Providence, R. I., to accept a position in the "New Business" department of the Auburn, N. Y., Light, Heat & Power Company.

SIR GEORGE DRUMMOND has resigned as president of the Mexican Light & Power Company, the main office of which is in Montreal, and has been succeeded by Mr. E. S. Clouston. Mr. H. V. Meredith has been elected a director to fill the vacancy caused by Mr. Drummond's resignation.

MR. THOMAS F. BECHTEL, who has been closely identified with the lighting and power business at Grand Rapids, Mich., has become interested in the George P. Hardy Electric Company, of Atlanta, Ga., which will now be known as the Hardy-Bechtel Electric Company, with Mr. Hardy as president and Mr. Bechtel as secretary and treasurer. They will handle, among other things, Century single-phase motors, etc., and "G. I." lamps.

MR. CARLOS GUINLE, of Rio de Janeiro, has arrived in New York to take charge of the American office of Guinle & Company, of which firm he is a member. He will succeed Mr. Arnaldo Guinle, who will go to Brazil about Jan. 1 The firm of Guinle & Company holds a valuable concession for a hydro-electric plant on the Piabanha River, near Rio de Janeiro, and has recently obtained the contract for supplying power to the Central Railway of Brazil, which expects to electrify 17 miles of line. The company also holds other valuable Brazilian contracts.

MR. L. B. MARKS, the well-known consulting electrical engineer, who has of late made a specialty of illuminating engineering, has formed a partnership with Mr. J. E. Woodwell for such expert work in mechanical and electrical consultation and in illumination. The firm has opened offices in the Terminal Building, Forty-first Street and Park Avenue, New York City. Mr. Woodwell was recently an engineer in the service of the United States Government at Washington. These gentlemen have already, in their individual capacity, a good many notable installations to their credit, covering a wide range.

Trade Publications.

GAS ENGINES.—Bulletin K of the Jahobson Machine Manufacturing Company, Warren, Pa., gives a well-prepared engineering discussion of gas and gasoline engines for electric lighting service.

ELECTRIC TOOLS.—The Chicago Pneumatic Tool Company, 1010 Fisher Building, Chicago, Ill., has issued a full set of bulletins devoted to electrical tools, including drills, hoists, grinders and blowers.

PASS & SEYMOUR, INC., of Solvay, N. Y., has issued a complete new price-list and discount sheet dated Sept. 9, giving a revised price-list of its entire line, and will be glad to send a copy to anyone in the trade on request.

TRANSFORMER STEEL.—An attractive pamphlet just issued by the General Electric Company, Schnectady, N. Y., and designated as No. 3687, gives a brief history of the material used in transformer construction and calls attention to the silicon steel used in its transformers.

ELECTRICAL ACCESSORIES.—The Amorduct Manufacturing Company, Ltd., Farringdon Avenue, London, England, E. C., has issued a well-illustrated 115-page catalogue in which all types of electrical lighting, signaling and ventilating accessories are illustrated, described and listed.

RECORDING INSTRUMENTS, including ammeters, voltmeters and wattmeters for both direct-current and alternating-current service, are listed and described in Pamphlet D. 20 of Elliott Brothers' Century Works, Lewisham, London, S. E., England. These instruments are sold in this country by John Bliss & Co., 128 Front St., New York.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., are distributing new data on transformers, employing the new alloy known as "silico vanadium steel." Accompanying these sheets is an exhaustive treatise on the mining, smelting and treatment of the ores from which this new alloy is obtained. In view of the wide interest taken in this new alloy by manufacturers, electrical engineers and central station managers, the publication is very timely and it will be sent upon request.

LEATHER SHOW EXHIBIT.—At the recent third annual National Shoe & Leather Market Fair, held in the Coliseum, Chicago, the Western Electric Company was the only electric exhibitor, and made an interesting display of its direct and alternating current motors, arc lamps, exhaust and desk fans, and intercommunicating telephone sets. In other exhibits Western Electric motors were seen driving shoe machinery. Four large exhibits were thus equipped and the display thus made excited most favorable comment.

STEADY VS. UNSTEADY VOLTAGE.—The economy with which a lighting system is operated is determined largely by the maintenance of constant voltage at the lamps; and by this voltage the customer primarily judges the excellence of the illumination. The automatic regulation of this voltage at the station is of vital importance. An attractive bulletin, No. 4619, just issued by the General Electric Company, of Schenectady, N. Y., on this subject, describes the manner in which this regulation may be accomplished.

Business Notes.

THE U. T. HUNGERFORD BRASS & COPPER COMPANY is making a specialty of hard-drawn copper wire for telephone, telegraph, trolley and long distance transmission lines. The requirements of modern specifications are very exacting in the way of tensile strength, elongation and conductivity, but the methods of manufacture followed by the company have enabled it to meet successfully the conditions imposed by the specifications.

THE CENTRAL ELECTRIC COMPANY, Chicago. Ill., has announced a second general reduction in the list prices of tungsten lamps; this reduction taking place Oct. 1, 1908, and the prices being subject to the latest discounts announced a short time ago. These new prices bring the net prices of tungsten lamps to a point which will greatly increase the sales, and, in anticipation of this demand, the Central Electric Company has accumulated and will maintain at least 10,000 Columbia tungsten lamps in Chicago stock for immediate delivery.

THE HARVARD ELECTRIC COMPANY, 66 West Van Buren street, Chicago, Ill., and 136 Liberty street, New York, N. Y., announces that although its Chicago factory and stock was seriously damaged by a fire which occurred Aug. 28, its new factory at Chicago, equipped throughout with modern and improved machinery, is now in full operation, and that orders for fuse wire, fuse links, telephone fuses, conduit boxes, sectional switch boxes, portable lamp guards, wire connectors, brass cleats, etc., will be filled promptly. The standard of "Harvard Specialties" will not only be maintained but will be heightened by new methods and improved means of manufacture.

WAGNER CENTRAL STATION TRANSFORMERS.—In an advertisement of the Wagner Electric Manufacturing Company that appeared in our columns last week, in referring to the efficiency of the central station transformers manufactured by that company, the phrase "Iron or copper losses are promperly proportioned" should, of course, have read "Iron *and* copper losses are properly proportioned." In this connection it should be pointed out that the purchaser of a transformer can have, at his election, either extraordinarily low core losses or extraordinarily low copper losses. Thus, the Wagner company has built, as an extreme of design, a 110-kw transformer with a core loss of one-quarter of 1 per cent. Such a transformer, however, would obviously not do for any kind of ordinary service.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 29, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N.Y.]

899,514. SWITCHBOARD SIGNAL-LAMP; Edward B. Craft, Wilmette, Ill. App. filed Feb. 1, 1907. In an incandescent electric lamp, the combination with a base of insulating material, said base having channels in its lateral surface, of a bulb and terminal plates secured to said bulb and base, said plates being provided with tongues lying in channels approximately flush with the tops thereof and with inturned portions engaging said base at each end of the channels to prevent the displacement of said tongues.

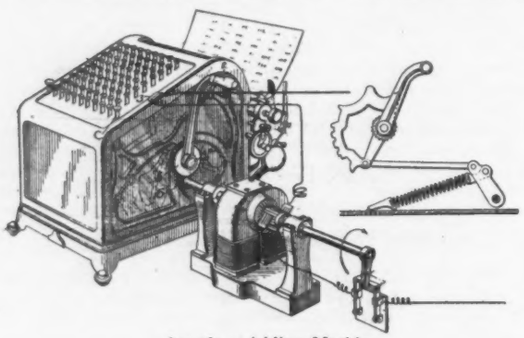
899,524. TELEPHONE CUT-OFF; Henry S. Gilbert and William F. Drake, Pueblo, Colo. App. filed Oct. 26, 1907. In a telephone attachment comprising a switch, means for attaching the same to the hearing end of the telephone receiver, a pair of conductors connected at one end to the switch terminals, and means at the other ends of said conductors for attaching them to the terminals of the microphone element of the transmitter.

899,535. ELECTRICAL SYSTEM OF DISTRIBUTION; Albert S. Hubbard, Belleville, N. J. App. filed Jan. 29, 1908. Supplies currents of different characters from generating apparatus driven from the same prime mover, such apparatus including a dynamo arranged to give out different characters of current, such as alternating and direct currents. Has a battery which is connected to and supplies only one of the circuits so as to maintain the total currents or loads of the two circuits substantially constant, by varying the battery action according as the total load on both circuits varies.

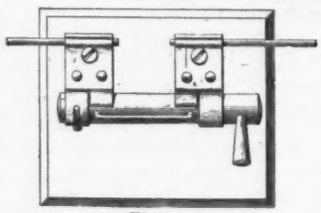
899,564. SELECTIVE SIGNALING SYSTEM; Harry O. Rugh, Sandwich, Ill. App. filed Dec. 9, 1907. A circuit selective appliance including electromagnetic step-by-step operating mechanism, a sluggishly moving circuit controlling element including an unbalanced lever, and a restraining element in the form of a weight normally imposed upon the lighter end of said lever to overcome the action of the heavier end of said lever, thereby normally preventing the operation of said circuit controlling element and removable from influence thereupon by said electromagnetic mechanism.

899,578. TROLLEY-POLE CATCHER; John H. Walker, Lexington, Ky. App. filed Dec. 26, 1907. A trolley pole is held elevated by a pair of links connected thereto of such a character as to actuate certain releasing pawls and permit the pole to drop in case of sudden upward movement.

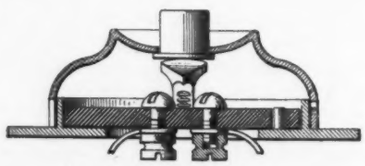
899,593. AUTOMATIC THIRD-RAIL CONTACT-SHOE GUARD; William E. Hayes, Frankfort, Ky. App. filed Jan. 22, 1908. An automatic third-rail contact-shoe guard having an insulating cover or guard for the contact-shoe, and means for raising or lowering said cover or guard.



899,983.—Adding Machine.



900,005.—Electric Switch.



900,006.—Push Button.

899,598. SOLENOID-MOTOR; Lemuel F. Howard, Edgewood Park, Pa. App. filed Oct. 23, 1906. A solenoid magnet has two cores, one with a conical recess and the other with a conical projection, which are attached together to elevate the semaphore blade.

899,629. CONVERTER; Harry Shoemaker, Jersey City, N. J. App. filed Dec. 20, 1906. A commutator is driven by a motor and has connection with resistances and inductances, so as to produce a perfect sinuous wave alternating current from an ordinary direct current.

899,634. HIGH-POTENTIAL SPARK-COIL; Chester H. Thordarson, Chicago, Ill. App. filed Dec. 23, 1907. A high-potential spark-coil including an inclosing casing, means arranged within the casing for generating a magnetic field, and a movable armature arranged outside the case and adapted to be operated by the influence of said magnetic field.

899,636. GROUNDING-CLAMP FOR ELECTRIC WIRES; Wheeler H. Vibber, New London, Conn. App. filed April 20, 1907. Includes a metallic strap which can be clamped around a pipe by a bolt on one side. The strap has inwardly directed spring tongues to permit of a good contact.

899,637. ELECTRIC-INSTALLATION MOLDING-BOX; Wheeler H. Vibber, New London, Conn. App. filed June 11, 1907. A molding-box designed to secure a neat junction between the box and the molding leading to it. Has a circular body with a plurality of shallow, rectangular molding-end recesses with orifices in alignment with the grooves and which have insulating bushings.

899,638. COMBINED BUSHING AND COUPLING FOR ELECTRIC INSTALLATION; Wheeler H. Vibber, New London, Conn. App. filed Jan. 30, 1908. An L-coupling for conduit pipes designed to be threaded on one branch and having a clasp engagement with the other whereby it may be removed without entirely disrupting the piping system.

899,639. BOX-CONNECTOR FOR ELECTRIC INSTALLATION; Wheeler H. Vibber, New London, Conn. App. filed June 4, 1908. A straight coupling having the same characteristics as above, is threaded at one end and has a slot and laterally displaceable collar at the other.

899,641. PLEASUREPHONE; Charles A. Wardner, Brushton, N. Y. App. filed April 19, 1907. In place of the usual receiver, the patentee has a receiver with its diaphragm connected by a multiplying lever, with a second larger diaphragm of mica or the like, which operates in connection with a megaphone.

899,705. METHOD OF PRODUCTION OF NITRATES; Claus Nissen Riiber, Christiania, Norway. App. filed Jan. 6, 1905. The process which consists in blowing air through an electric arc in a suitable furnace and leading the gas mixture so formed directly into compounds of alkalies or alkaline earths contained in a chamber separate from the furnace.

899,708. CONNECTION FOR ELECTRIC CONDUCTORS; Frank H. Ball, North Plainfield, N. J. App. filed Aug. 6, 1906. A connector for dry cells, including a spring clip with a pair of blades having aligned holes through which the conductor is received, and which spread apart to hold the conductor in place.

899,717. CONTROLLER-REGULATOR; Cyrus P. Ebersole, Keokuk, Ia. App. filed Dec. 16, 1907. A yieldable clamp connection between the hood of the controller regulator and controller handle, designed to accommodate various sizes and makes of handle. Has a pawl and detent arrangement to cause a slow, step by step movement of controller when the motors are started.

899,749. FIRE-ALARM; Bernard B. Mears, Baltimore, Md. App. filed Nov. 16, 1907. A disk of celluloid on the exterior of an inclosed box normally resists the movement of a spring-impelled plunger adapted to move and close an alarm circuit in case the celluloid is destroyed.

899,787. TELEPHONE SYSTEM; Alfred H. Dyson, Chicago, Ill. App. filed Feb. 5, 1906. Has means to enable operators to transmit directive currents to selective switches to cause them to correct answering means with terminals of particular lines.

899,822. CLUTCH; Heinrich Ast, Vienna, Austria-Hungary. App. filed June 15, 1906. A magnetic clutch including a pair of annularly related surfaces, one having an inset armature and the other having a magnet coil. Has spring means by which the parts are prevented from jamming sidewise when the clutch is not in operation.

899,823. PRIMARY BATTERY; Wilhelm Alexander Felix Bleeck, Brisbane, Queensland, Australia. A primary battery of the double fluid type having sodium hydroxid as excitant with a depolarizer consisting of chromic acid dissolved in a solution of hydrogen peroxid with the addition of hydrochloric acid, as described.

899,827. PROCESS OF MAKING INGOTS; Frank Cutter, Providence, R. I. App. filed April 23, 1908. The process of making cylindrical ingots adapted to be reduced to seamless wire, which consists in depositing upon a metallic rod by electrolysis a film of another metal, and impacting simultaneously all parts of the metal after it is so deposited upon the rod.

899,850. TELEPHONE EXCHANGE APPARATUS; Emil Tanke, Berlin, Germany. App. filed June 17, 1905. In a telephone system, the combination with a plurality of calling groups and their respective annunciators; of a subscriber's station, a relay having two coils, and a single coil relay, a circuit leading from said subscriber's station through one coil of said two-coil relay to control one annunciator, and another circuit leading through the other coil of said two-coil relay and through the single-coiled relay to control another annunciator.

899,858. TROLLEY-WIRE HANGER; James Bryan, Pittsburg, and Harry Etheridge, McKeesport, Pa. App. filed March 20, 1907. A connect on for the ear and insulator hood adapted to permit different alignments between the trolley and the guy wire in which the guy wire is arched upward over the trolley wire so that the latter is substantially in horizontal alignment with the strain on the guy wires. Makes use of a special bolt lock for holding the parts together.

899,859. AERIAL-TROLLEY SUPPORT; James Bryan, Pittsburg, Harry Etheridge, McKeesport, and Edgar McCormack Balsinger, Pittsburg, Pa. Relates to a supporting arm for the above hanger which projects laterally from a central post, and has a pair of depending insulator stud between which a short guy wire is tightly stretched.

899,906. COMBINED LOCK-NUT AND BUSHING FOR CONNECTION-BOXES; Joseph Sterner Ritter, Allentown, Pa. App. filed April 16, 1908. A bushing adapted for insertion through an opening in the wall of an outlet box and threaded interiorly to receive the pipe, and having a thin annular flange adapted to be beaded over within the box in the manner of a boiler tube.

899,983. ADDING-MACHINE; William Smith Horry, Niagara Falls, N. Y. App. filed Sept. 26, 1903. A power device to operate an adding-machine. Has a magnetic switch in circuit with a motor at one point and means operated by the armature of the motor for automatically closing and opening the circuit at another point.

900,005. ELECTRIC SWITCH; Charles W. Watchel, Jamaica, N. Y. App. filed Nov. 23, 1907. A form of switch for toys and household tools, etc., designed for small current carrying capacity and intended to be very cheaply made.

900,006. PUSH-BUTTON; Charles W. Wachtel, Jamaica, N. Y. App. filed Nov. 23, 1907. A form of push-button designed to give a positive wiping contact between the two poles of the circuit.

900,035. ELECTRIC-MOTOR STARTER; William C. O'Brien, Baltimore, Md. App. filed Oct. 23, 1905. An automatic starter for motors which will operate to cut out the starting resistance from the armature circuit as the motor acquires speed, without the use of dash pots or mechanical retarding devices, or sliding contacts.